UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
SOLID WASTE AND EMERGENCY RESPONSE

March 27, 1991

MEMORANDUM

SUBJECT: Review of Mining NPL Site Summary Reports

FROM: Steve Hoffman, Mining Waste Section
Special Waste Branch
Office of Solid Waste (OS-323W)
FTS 398-8413

Steve Golian, Section Chief
Remedial Operations Guidance Branch
Office of Solid Waste and Emergency Response
FTS 398-8359

TO: Scott Brown
Remedial Project Manager
EPA Region VIII

The Special Wastes Branch in the Office of Solid Waste is currently in the early stages of developing a mining waste program. As part of this program development, EPA has prepared Mining NPL Site Summary Reports to describe environmental damages and associated mining waste management practices at sites on the NPL.

Your previous assistance in identifying and sending pertinent information to our contractor, Science Applications International Corporation, is appreciated. However, the Mining NPL Site Summary Reports would benefit from your review. We originally mailed copies of the Draft Site Summary Report(s) to the designated RPMs on February 15, 1991. However, in the process of making follow-up phone calls we were informed that some RPMs never recieved their packages. We are therefore enclosing another copy of NPL Site Summaries for which you are designated RPM, for your review. As this is a cooperative effort, please review each Draft Report, mark comments on the Draft, and send it to Steve Hoffman by April 15, 1991. If you have any questions, please contact Steve Hoffman at FTS 398-8413. Thank you.

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Mining Waste NPL Site Summary Report

East Helena Smelter Site
East Helena, Montana

U.S. Environmental Protection Agency
Office of Solid Waste

November 9, 1990

Prepared by:

Science Applications International Corporation
8400 Westpark Drive
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EPA Contract No. 68-WO-0025
SAIC Project No. 01-834-03-342-30

Mining Waste NPL Site Summary Report

East Helena Smelter Site
East Helena, Montana

Introduction:

This NPL Site Summary Report for the East Helena Smelter Site has been developed as one of several NPL Site Summary Reports and will be used to support EPA mining waste rulemaking activities. In general, these reports summarize the types of environmental damages and associated mining waste management practices at sites on the National Priorities List (NPL) as of February 21, 1990 (55 Federal Register 6154). Each summary report is based on pertinent information gathered from EPA files and reports. This Summary Report contains information up to date as of August 22, 1990. The Region VIII Remedial Project Manager for this site is Scott Brown, (406) 449-5414.

Overview:

The East Helena Smelter Site is an active primary lead smelter in East Helena, Lewis and Clark County, Montana which occupies approximately 80 acres. The smelter began operations in 1888, recovering base metals using a pyrometallurgical process. Lead bullion is produced for further refining at other facilities. From 1927 to 1982 the plant also recovered zinc from the smelter's waste slag. In 1955, a paint pigment plant was constructed adjacent to the smelter; it is still in operation (Reference 4, page 1).

The sources of contamination at the site are primary and fugitive emissions and seepage from process ponds and process fluid circuitry. Contamination effects have been measured over a 100 square mile area (Reference 1, pages 1-3 and 1-5). Arsenic, cadmium, lead, copper, and zinc are the primary contaminants of concern (Reference 1, page 6-15). East Helena's community of over 1,600 people are within a 1/4 mile north of the site and approximately 3 miles to the west is the City of Helena, with a population of over 35,000 (See map in Reference 1). Of principal concern is the contamination of shallow aquifers that may be used as drinking water sources and contamination of surface water, and soils (Reference 1, page 1-3).

Numerous environmental investigations have been prepared for the site dating as far back as 1969 the Montana State Air Quality Bureau (AQB) began sampling and monitoring site emissions through the mid-1970's. Also, in 1969, the USGS studied soil contaminants in the smelter area and in 1972, EPA performed environmental pollution studies which included sampling vegetables grown in the vicinity. The Center for Disease Control conducted blood-lead level testing of area residents in 1975 and additional blood-lead level studies were performed in 1983 and 1989 by the Lewis and Clark County Health Department and Asarco (PRP) respectively. A Record of Decision (ROD) has been prepared, in accordance with CERCLA, for one of five identified operable units at the site requiring remediation. The ROD has been signed by the Region VIII Administrator and concurred by the State of Montana. Draft remedial investigation and feasibility studies (RI/FS) have been prepared for the four remaining operable units and are currently under review by EPA.

Operating History:

The East Helena lead smelting facility is owned and operated by Asarco, formerly American Smelting and Refining Company. The zinc recovery plant was constructed and operated by the Anaconda Company beginning in 1927 but was purchased by Asarco in 1972. Adjacent to the smelter is a paint pigment plant owned and operated by American Chemet Corporation. Asarco, Anaconda, which is currently a division of ARCO Coal Company, and the American Chemet Corporation have been identified as potentially responsible parties (PRPs) at this site.

In an effort to expedite remedial investigation and feasibility studies, the East Helena Smelter Site has been segregated into five operable units:

- process ponds and fluids;
- groundwater;
- surface water, soils, vegetation, livestock, fish, and wildlife;
- slag pile;
- ore storage areas (Reference 1, page 5-1).

Four major process fluid ponds were addressed in the ROD. The process ponds are used for the collection and storage of water for use in the main plant process circuits, for cooling hot speiss during speiss granulation processing, for recirculation into the scrubber and sinter plant, and for preliminary settling of suspended solids. Three of the four processing ponds are still in operation. EPA identified these process ponds operable units as requiring the most immediate remediation because it constituted a source of contamination to shallow ground water in East Helena and also because it constituted the most immediate threat to human health and the environment. Elevated levels of arsenic, lead and other elements were found in the process fluids and underlying soils. Sampling revealed on-site arsenic levels as high as 120,000 mg/kg and lead levels up to 38,000 mg/kg

(Reference 1, page 5-7). This summary report will concentrate on information provided in the ROD which assesses environmental damages and risks associated with the process ponds operable unit.

Site Characterization:

The East Helena Plant is located on unconsolidated quaternary alluvium deposited by the Prickly Pear Creek drainage, which is underlain to the west and north of the site by fine-grained tertiary volcanic deposits of low permeability (Reference 1, 1-3). Groundwater in the unconsolidated quaternary deposits generally follow to the north and receives recharge from Prickly Pear Creek which discharges approximately seven miles to the north into Lake Helena. (See map in Reference 1). (Reference 2, page 1-12). Surface water sources around the plant include Prickly Pear Creek, Lake Helena, Upper Lake located south of the plant, Lower Lake located north of Upper Lake, and Wilson Ditch, which provides an irrigation diversion from Upper Lake (Reference 2, page 1-12 and map in Reference 3, page 5).

Seasons within the Helena Valley, where the plant is located, consist of "cold winters with significant snowfall accumulations at higher elevations, warm summers with moderate thunderstorm activity, and a fairly consistent wet spring". Annual precipitation is approximately 10 inches (Reference 1, pages 1-1 through 1-3).

The ROD, completed and signed in November 1989, identifies five potential sources of contamination at the East Helena Smelter Site: smelter air emissions, a slag pile, ore storage areas, process ponds, and process fluids. Documented contamination has been found in air, surface soils, groundwater, and surface water. Sampling shallow groundwater under parts of East Helena, 1/4 mile north of the site, show levels of dissolved arsenic at approximately 1.2 mg/l (Reference 1, page 5-1).

The four major process fluid ponds addressed in the ROD include:

- Lower Lake: collects and stores water used in the main plant process circuits and runoff from the plant site. The pond is approximately 7 acres in surface area and has a capacity of about 11 million gallons.

- Speiss Granulating Pond and Pit: stores water used to cool hot speiss during speiss granulation operations. The pond is lined with 8 inches of concrete and is approximately 20 by 70 feet with a maximum depth of 4 feet. In August, 1988, a high density polyethylene liner was also installed over the concrete.

- Acid Plant Water Treatment Facility: consists of a wooden trough fluid transport system, five particulate settling dumpsters, and a 68-by-35-by-9 feet deep settling pond. The facility removes particulates from scrubber fluid. A concrete pad underlies the dumpsters and the wooden trough. The pond is lined with concrete and an asphalt liner.

- Former Thornock Lake: previously used for preliminary settling of suspended solids from main plant operations. This unit contains no process fluids and is no longer in operation (Reference 1, pages 1-5, and 5-5 through 5-8).

Soils - Soil samples taken at the four processing pond units show levels of arsenic and lead at high concentrations. Contaminant levels at the speiss granulating pond and pit were measured at 1,750 mg/kg arsenic and 5,500 mg/kg lead. Saturated soils at this unit show levels of dissolved arsenic as high as 700 mg/l (Reference 1, page 5-6). Soil samples taken under the acid plant contain up to 12,000 mg/kg arsenic and 14,000 mg/kg lead. Contaminant levels decrease with increasing depth under all the processing pond units. However, acid plant soils and sediments exhibit EP toxicity throughout the tested soil profile (Reference 1, page 5-7). Residential soils testing revealed that roughly 50 percent of the yards and play areas sampled within East Helena have more than 1,000 ppm lead in the surface soil. Many of these samples were found to have more than 2,000 ppm lead and some are in the range of 3,000 - 7,000 ppm (Reference 3, page 3).

Sediments - Sampling of bottom sediments at the process fluid ponds reveal high concentrations of arsenic, lead and other metals. Lower Lake sediments contain up to 2,800 mg/kg arsenic and 15,000 mg/kg lead. Dried sediments from Former Thornock Lake contain up to 120,000 mg/kg arsenic and 38,000 mg/kg lead. Other elements are also present at elevated concentrations. Contaminant concentrations decrease with increasing depth. All bottom sediments at lead smelter ponds have been classified by EPA as hazardous waste (Reference 1, pages 5-5 through 5-8).

Process waters - Sampling of Lower Lake process waters shows elevated levels of arsenic and lead containing up to 25 mg/l total arsenic and 48 mg/l total lead. Concentrations of other metals including cadmium, copper and zinc in the process waters are similarly elevated. Process waters from Lower Lake are often added to the Speiss granulating pond and pit waters when makeup water is needed (Reference 1, pages 5-5 through 5-8 and page 6-7).

elevated arsenic concentrations. A northwest trending, relatively high concentration arsenic plume has been delineated in the shallow alluvial groundwater system on the plant site. Primary sources of this plume are the speiss granulating pond and pit and the acid plant water treatment facility and sediment drying areas. This plume is superimposed on a broader, lower concentration plume extending to the north. Arsenic concentrations are significantly reduced in East Helena and are near or below MCLs (0.05 mg/l) at the north edge of the community. Few private wells are still used in East Helena (Reference 2, pages 3 and 4).

Contaminants detected in the process pond areas have migrated toward downgradient (north of the site) receptor areas and other environmental media on site as well as off site (Reference 1, page 6-6). Although the highest concentrations of contaminants are found underneath and adjacent to the four process ponds, the more mobile elements, such as arsenic, have been transported by natural groundwater movement into aquifers and soils underlying East Helena (Reference 1, page 6-15). Subsurface soil- and sediment-to-groundwater, and groundwater-to-surface water are the primary migration pathways of potential importance identified in the feasibility study (Reference 1, page 6-6).

Environmental Damages and Risks:

Initial interest in the site began in 1969 when a study was prepared for arsenic, lead, zinc, and sulfur dioxide emissions. Sulfur dioxide and lead emissions were not in compliance with State and Federal emissions and air quality standards. Several blood-lead level studies and an EPA pollution study were also conducted and the results, including blood-lead levels in local children which were as high as twice the national average, eventually led to remedial investigations and site endangerment assessments (Reference 4 page 3a). These studies showed there was contaminated soils in East Helena residential areas and elevated metals levels in the air. The site was listed on the National Priorities List (NPL) of Superfund sites in September, 1983 (Reference 1, page 2-5).

The endangerment assessment (EA) prepared in support of the feasibility study for the process ponds presents a human health risk assessment. The EA lists the media of concern as "contaminated sediments in Lower Lake and former Thornock Lake, contaminated soils at the acid plant water treatment facility and the speiss granulating pond and pit, process water in all areas except former Thornock Lake, surface water in Prickly Pear Creek, and groundwater below the site and East Helena." (Reference 1, page 6-1).

Contaminant migration pathway analyses indicate that on-site workers have the potential for direct contact with contaminants in the process ponds and other affected media on site. Off-site receptors, including humans, vegetation, and wildlife may be exposed to surface water contamination in Prickly Pear Creek which flows to nearby Lake Helena. Seepage from Lower Lake into Prickly Pear Creek contributes to ongoing violations of State water quality standards principally caused by mining leachate entering the creek upstream of the smelter. In addition, monitoring wells show that arsenic, at concentrations greater than 20 times the Federal drinking water MCL (i.e. 1000 ppm), has migrated to shallow groundwater in East Helena (Reference 1, page 6-16). The population in East Helena, according to the 1980 Census, is approximately 1,600. Although these contaminated groundwater sources are not part of the existing drinking water supply for East Helena, they are considered potential future drinking water sources and the potential exists for the arsenic to migrate into deeper (drinking water) aquifers (Reference 1, page 6-16).

Constituents of primary concern as contributing to environmental damage include arsenic, lead, cadmium, zinc and copper. Of these, arsenic is the greatest concern due to its mobility and its carcinogenicity (Reference 1, page 6-15). The comprehensive RI/FS will address problems associated with contaminated soils and groundwater under East Helena as well as health risks for all completed exposure pathways on site and off site.

Remedial Actions and Costs:

The East Helena Smelter Site was included on the NPL in September, 1983. A Record of Decision (ROD), describing the final, planned EPA remedy for one of five operable units has been signed by the Region VIII Administrator and the State of Montana. The selected remediation activities and cost data for the four process fluid ponds are described below. These estimates do not include the time necessary to smelt all excavated soils and sediments which is expected to require 12 to 15 years. In addition, remediation costs cited here do not reflect lost revenue for smelting contaminated soils on site.

Lower Lake - The selected remedy for Lower Lake includes:

- Replace Lower Lake with 2 million gallon storage tanks
- Construct a lined pond for storm water runoff (100 year, 24 hour storm)
- Install co-precipitation of Lower Lake process waters and fluids
- Remove sediments by dredge, dragline, or industrial vacuum (approximately 27,000 dry tons of sediment)

- Dry sediments on a concrete drying pad underlain by sand, a leachate collection system and a liner, and store in building
- Smelt excavated sediments in the smelter process.

Present worth costs for Lower Lake remediation activities are approximately $6 million over five years (Reference 1, pages 7-10, 7-16 through 7-19, 9-2, 10-23, 11-2, and 11-4).

Speiss Granulating Pond and Pit - The selected remedy includes:

- Replace existing pond with a steel tank with a liner and a secondary containment facility
- Replace existing pit with a new steel lined concrete facility
- Excavate 20 feet of soil (3,700 cubic yards) as part of new construction
- Smelt contaminated soils in the smelter process.

Present worth costs for Speiss Granulating Pond and Pit remediation activities are approximately $751,000 over two years. The ROD indicates that an additional 12 to 18 months will be required for pit remediation (Reference 1, pages 7-10, 7-22 through 7-25, 9-4, 10-24, and 11-4 through 11-5).

Acid Plant Water Treatment Facility - The selected remedy includes:

- Replace existing pond and settling system with closed circuit filtration treatment system
- Excavate underlying contaminated soils to a depth of 20 feet (approximately 6,250 cubic yards of soil)
- Smelt contaminated soils in the smelter process

Present worth costs for the Acid Plant Water Treatment Facility remediation activities are approximately $2.8 million over two years (Reference 1, pages 7-10, 7-28 through 7-30, 9-5, 10-25, and 11-5).

Former Thornock Lake - The selected remedy includes:

- Excavate bottom sediments to a two foot depth below artificially deposited layer of sediments
- Temporarily stockpile contaminated sediments
- Smelt sediments in smelter process

Present worth costs for Former Thornock Lake remediation activities are $19,000 over six months (Reference 1, pages 7-10, 7-33 through 7-35, 9-6, 10-26, and 11-5 through 11-6).

Current Status:

In the process of negotiations between EPA and the PRP, a consent decree was signed on June 30, 1990 in support of the ROD on the process ponds operable unit. In addition, a comprehensive RI/FS is in draft stage for all remaining operable units at this site (Reference 5).

References:

1. Record of Decision for the East Helena Smelter Site Process Ponds Operable Unit, East Helena, Montana; James J. Scherer, Regional Administrator EPA Region VIII; November 22, 1989.

2. Executive Summary to the Draft Comprehensive RI/FS for remaining operable units and sub units; 1990

3. Superfund Program Fact Sheet, East Helena Smelter Site, EPA Region VIII and Montana Department of Health and Environmental Sciences, April 1989

4. Superfund Program Proposed Plan, East Helena Smelter Site, EPA Region VIII and Montana Department of Health and Environmental Sciences, August 1989

5. Telecon August 22, 1990, between Mary Wolfe, SAIC, and Scott Brown, EPA Region VIII.

Bibliography:

1. Executive Summary to the Draft Comprehensive RI/FS for remaining operable units and sub units; 1990

2. Record of Decision for the East Helena Smelter Site Process Ponds Operable Unit, East Helena, Montana; Scherer, James J., November 22, 1989.

3. Superfund Program Fact Sheet, East Helena Smelter Site, EPA Region VIII and Montana Department of Health and Environmental Sciences, April 1989

4. Superfund Program Proposed Plan, East Helena Smelter Site, EPA Region VIII and Montana Department of Health and Environmental Sciences, August 1989

5. Telecon August 22, 1990, between Mary Wolfe, SAIC, and Scott Brown, EPA Region VIII.

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Reference 1

(Record of Decision, Process Ponds Operable Unit, East Helena Smelter Site)

1 DESCRIPTION OF SITE

The East Helena Smelter Site is located in the community of East Helena, in Lewis and Clark County, Montana (see Figure 1-1). The site is the location of a primary lead smelter that has operated for 100 years and has also recovered zinc during much of its existence. The plant site, occupying approximately 80 acres, is owned and operated by Asarco, formerly American Smelting and Refining Company, and the sources of contamination are from within the plant site.

The community of East Helena has a population of 1,676 according to the 1980 census. Approximately 3 miles to the west is the City of Helena, with a population of over 35,000. Residential areas of East Helena are within 1/4 mile of the main area, separated from the site by U.S. Highway 12 and a rail line.

The site is located in the Helena Valley of western Montana. Seasons typically consist of cold winters, warm summers with moderate thunderstorm activity, and a fairly consistent wet spring. Much of the moisture in the area comes in the form of late spring and early summer rain, and there are significant winter snow accumulations at higher elevations in

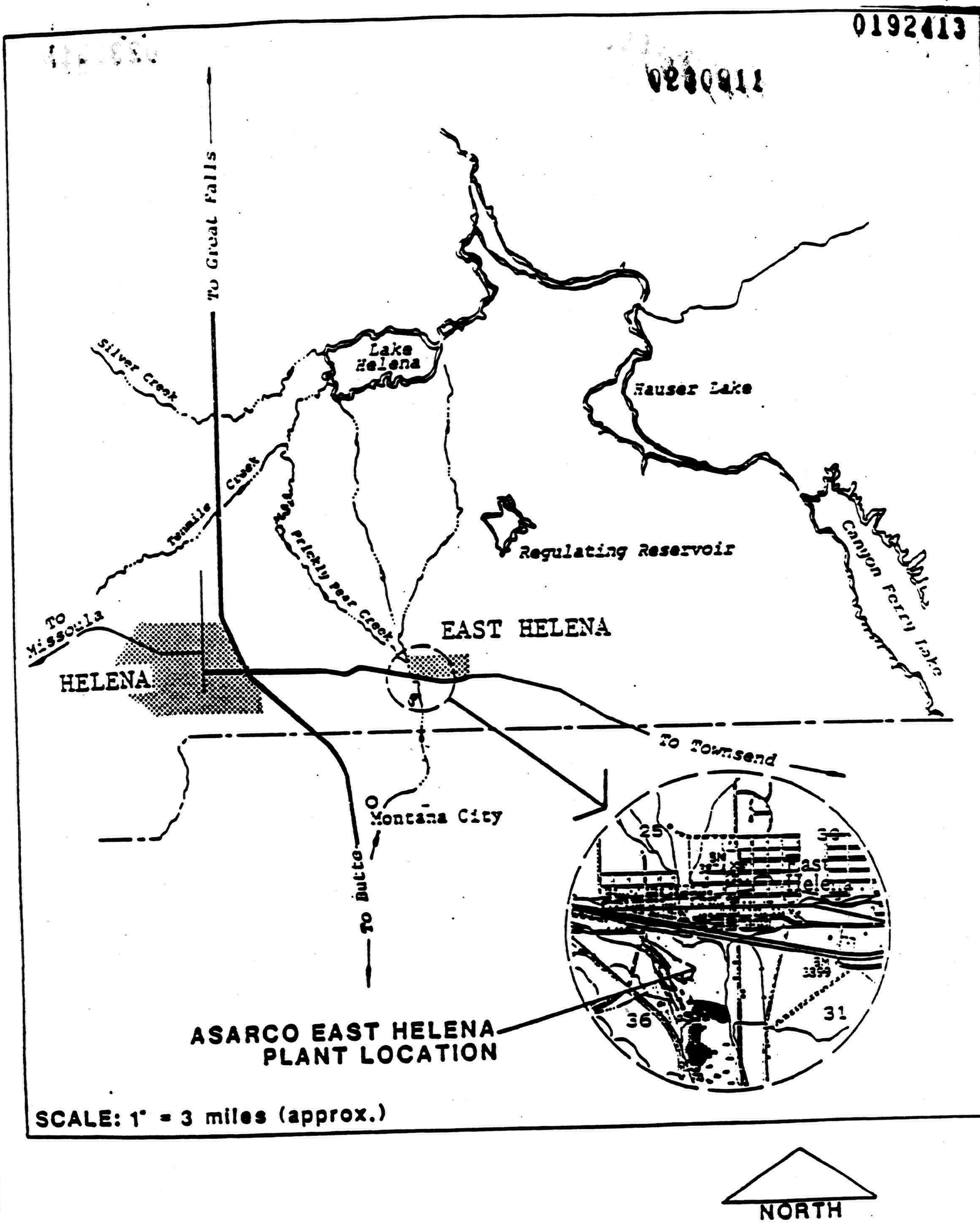

Figure 1-1. Location Ma

the mountains peripheral to the Helena Valley. Annual precipitation averages about 10 inches in the Helena area.

The East Helena Smelter Site is adjacent to Prickly Pear Creek. The site is underlain by unconsolidated alluvium deposited by the ancestral Prickly Pear Creek. The alluvial deposits have variable permeabilities and consist of layers and mixtures of cobbles, gravel, sand, silt, and clay. Underlying the alluvium and present exposures west and north of the site are fine-grained Tertiary volcanic ash tuff deposits, having low permeabilities, and having weathered to a fine-grained clay in some locations. Surface water and groundwater in the area flow from south to north, exiting in the northeastern corner of the Helena Valley into Lake Helena.

The sources of contamination at the site are primary and fugitive emissions and seepage from process ponds and process fluid circuitry. The affected media include underlying soils, groundwater, surface water, vegetation, livestock, fish, and other aquatic organisms, wildlife, and the air of the Helena Valley. The effects of the contamination have been measured over a 100-square-mile area.

The areas covered by this ROD include the process ponds: Lower Lake, the speiss granulating pond and pit, the acid plant water treatment facility, and former Thornock Lake. Their locations are shown in Figure 1-2.

Lower Lake collects and stores water utilized in the main smelter process water circuit as well as storm water runoff. The speiss pond stores water that is used in the speiss pit to cool the hot speiss from the dross plant as part of a granulation process. The acid plant water treatment facility removes particulates from the scrubber fluid. Former Thornock Lake was used to settle suspended solids from the main process water circuit. In October 1986, the lake was replaced by a tank and the lake is no longer in use.

The primary contaminants are arsenic and heavy metals in the process fluids beneath the process ponds which are in turn the principal sources of groundwater contamination at the site. The stratigraphy underlying Lower Lake consists of 1 to 3 feet of artificially deposited sludge and partially suspended silt and clay, underlain by 13 to 15 feet of fine-grained sediments. Concentrations of arsenic and metals in Lower Lake sediments are the highest in the upper 1 to 3 feet and generally decrease with depth. Strata near the speiss granulating pond and pit and the acid plant water treatment facility consist predominantly of gravels and cobbles in a sandy silt matrix. Arsenic and metals concentrations are higher near the surface and generally decrease with depth with some increase in the saturated zone. Former Thornock Lake bottom sediments generally consist of fine-grained, plastic organic clay with elevated concentrations of arsenic and metals, and are underlain by coarse-grained sand, gravel, and cobbles. Arsenic and metals concentrations decrease with depth.

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- Docket number CERCLA VIII-84-006: Phase I remedial investigations of surface water and groundwater, and site endangerment assessment
- Docket number CERCLA VIII-89-10: Phase II remedial investigations, endangerment assessment, and feasibility study of all contaminated media at this site

General Notice Letters and Requests for Information, pursuant to 104(e) of CERCLA were sent to the American Chemet Corporation on February 23, 1987, and to the Arco Coal Company on March 12, 1987.

The administrative record, available for public review at the EPA (301 South Park, Helena, Montana), contains a complete documentation of administrative orders for the site. The site was listed on the National Priorities List (NPL) of Superfund sites in September 1983. The events that led to the site's listing on the NPL included findings of contaminated soils in East Helena residential areas, elevated metals levels in the air, and contaminated process ponds over shallow ground water near the plant.

The EPA began its Remedial Investigation (RI) field work in May 1984. The resulting Phase I RI data report for soils, vegetation, and livestock was released in May 1987. Asarco

5 SUMMARY OF SITE CHARACTERISTICS

5.1 CONTAMINATION SOURCES

There are five potential sources of contamination at the East Helena Smelter Site: smelter air emissions, the slag pile, ore storage areas, process ponds, and process fluids. The contaminants of primary concern are arsenic, cadmium, lead, copper, and zinc. Contamination from the plant has been found in air, surface soils, groundwater, and surface water. Dissolved arsenic in the shallow groundwater under portions of East Helena has been measured at approximately 1.2 mg/L. Contamination from these media has affected humans, livestock, vegetation, and fish, although the effects have not been fully defined. Under certain conditions, heavy metals contamination can lead to several human health problems including central nervous system damage, kidney disease, and cancer. Analytical data for water and sediments are shown in Table 5-1 and Figure 5-1, respectively. Locations of sampling points are shown in Figure 5-2.

Several ponds at the site are used for storing water from Prickly Pear Creek as well as for retention of process water. This ROD addresses four major process fluid ponds: Lower Lake, the speiss granulating pond and pit, the acid plant water treatment facility, and former Thornock Lake (refer to Figure 1-2).

5.1.1 LOWER LAKE

Lower Lake collects and stores water used in the main plant process circuits and runoff from the plant site. The pond is approximately 7 acres in surface area and has a capacity of about 11 million gallons.

Lower Lake process waters contain up to 25 mg/L total arsenic and 48 mg/L total lead. Concentrations of other metals in the process waters are similarly elevated. The bottom sediments of Lower Lake contain up to 2,800 mg/kg arsenic and 15,000 mg/kg lead. Concentrations of other elements in the bottom sediments are similarly elevated and these concentrations decrease with increasing depth (refer to Figure 5-1). The EPA has classified such bottom deposits in surface impoundments at all lead smelters as a hazardous waste.

5.1.2 SPEISS GRANULATING POND AND PIT

The speiss granulating pond provides storage for water used to cool the hot speiss from the dross plant. During speiss granulation, molten material is allowed to flow into the pit. Water pumped from the speiss pond is fed through sprayers onto the hot speiss material in the pit.

The water then drains through a 12- to 14-inch-diameter mild steel pipe back to the speiss granulating pond. This water is again recirculated during the granulating process. Plant process water from Lower Lake is added to the pond when makeup water is needed. The speiss granulating pit was constructed on the original concrete slab on the ground floor of the dross reverb building. Mild steel plating was used to make an enclosure for this pit. The speiss granulating pond is lined with 8 inches of concrete and is approximately 20 by 70 feet with a maximum depth of 4 feet. In August 1988, a high density polyethylene (HDPE) liner was installed over the concrete in the speiss pond.

Soils under the speiss granulating pond and pit contain up to 1,750 mg/kg arsenic and 5,500 mg/kg lead. Concentrations of all elements decrease with increasing depth. Dissolved arsenic in saturated soils under this area is as high as 700 mg/L.

5.1.3 ACID PLANT WATER TREATMENT FACILITY

The acid plant water treatment facility consists of a wooden trough fluid transport system, five particulate settling dumpsters, and a 68- by 35- by 9-feet-deep settling pond. The facility is used to remove particulates from the scrubber fluid which is then recirculated to the scrubbers or the sinter plant. A concrete pad underlies the five in-line dumpsters. There are no berms around the pad, and fluids leaking onto the pad spill over onto the ground surface. The wooden trough transport system is underlain by concrete and the natural ground surface. The settling pond is lined with concrete which is protected from the acidic process fluids by an asphalt liner. Soils under the acid plant contain up to 12,000 mg/kg arsenic and 14,000 mg/kg lead. Concentrations of all elements decrease with increasing depth; however, the soils under the acid plant differ from soils and sediments under the other process ponds by exhibiting characteristics of EP toxicity throughout the soil profile tested.

5.1.4 FORMER THORNOCK LAKE

Former Thornock Lake was also part of the main plant process water circuit and was used primarily for preliminary settling of suspended solids. However, in October 1986, Thornock Lake was replaced by a steel holding tank. This former lake no longer contains process fluids and only bottom sediments remain.

Sediments from former Thornock Lake (now dry) contain up to 120,000 mg/kg arsenic and 38,000 mg/kg lead. Concentrations of other elements are similarly elevated and these concentrations decrease with increasing depth. Bottom sediments of former Thornock Lake and all other bottom sediments at all lead smelters have been classified by the EPA as a hazardous waste.

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6 SUMMARY OF SITE RISKS

6.1 HUMAN HEALTH RISKS

An endangerment assessment (EA) was prepared in support of the feasibility study for the process ponds. This EA evaluated the current and potential future risks to onsite workers at the Asarco smelter and discussed the contaminant release and migration mechanisms responsible for transport of contaminants from onsite source areas to offsite areas or other environmental media. The following discussion is based on the EA presented as part of the process ponds feasibility study.

6.1.1 CONTAMINANT IDENTIFICATION

The media of concern include contaminated sediments in Lower Lake and former Thornock Lake, contaminated soils at the acid plant water treatment facility and the speiss granulating pond and pit, process water in all areas except former Thornock Lake, surface water in Prickly Pear Creek, and groundwater below the site and East Helena.

Twenty seven chemicals (metals and arsenic) were analyzed in the media identified above. Inorganic contaminants are present throughout the soils, sediments, surface water, and groundwater at the site. Indicator chemicals were selected from the parameter list to identify the contaminants that pose the greatest potential (or, the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's reference dose). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the Hazard Index (HI) can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

Environmental monitoring activities performed at the process pond areas have confirmed the presence of contaminants of concern in surface water, groundwater, subsurface soils, and sediments. The primary sources include:

1. Process fluids associated with the process ponds (i.e., Lower Lake, speiss pond/pit, and acid plant water treatment facility)

2. Soils and sediments associated with the process ponds (Lower Lake, speiss pond/pit, acid plant water treatment facility, and former Thornock Lake)

Contaminants detected in the process pond areas have migrated toward the downgradient receptor areas and other environmental media onsite as well as offsite.

The environmental fate and transport analysis presented in the feasibility study identified subsurface soil- and sediment-to-groundwater, and groundwater-to-surface water as the primary migration pathways for metals and arsenic from the process ponds. Other migration pathways of potential importance, surface soil-to-air, surface soil-to-surface water, and air-to-surface soil, were not considered in the feasibility study.

Based on the results of the environmental fate and transport analysis, a screening of current and potential future exposure pathways was conducted to determine which pathways could potentially expose receptors to arsenic, cadmium, lead, copper, and zinc migrating from the source areas. The screening step removes from consideration those exposure scenarios in which arsenic, cadmium, lead, copper, and zinc may be released from the site but for which there is less potential for exposure. The relative importance of these exposure scenarios compared to other exposure routes is not defined.

The elevated levels of arsenic, cadmium, lead, copper, and zinc identified in the process fluids, sediments, subsurface soil samples, and groundwater samples collected during the process pond RI in conjunction with the results of the contaminant migration pathway analysis indicate that onsite workers have the potential for direct contact with contaminants in the process ponds and other affected media onsite. Exposure pathways exist for those receptors that may come into contact with groundwater, surface water, subsurface soils, and sediments associated with the process ponds. Although onsite workers' occupational health and well-being is regulated under OSHA, the exposure pathways are complete for those

Bonasa sp.). Also present during certain periods are migrating waterfowl.

The major vegetative rangeland types in the Helena Valley are foothill grasslands and Lodgepole pine/Douglas fir forests. The foothill grasslands are at a higher elevation than the Montana plains grasslands and consequently receive more precipitation and produce more forage. Lodgepole pine (Pinus contorta)/Douglas fir (Pseudotsuga menziesii) forest can be found on mesic north-facing slopes at intermediate elevations (U.S. EPA, 1987).

6.3 CONCLUSIONS

Fluids contained within the four process ponds exhibit high concentrations of some 18 to 20 elements that are hazardous substances, including arsenic, cadmium, copper, lead, and zinc. These elements have seeped into the soils and groundwater both on and off the plant site. Although the highest concentrations are found underneath and adjacent to the four process ponds, the more mobile elements, such as arsenic, have been transported by natural groundwater movement into aquifers and soils underlying East Helena.

Arsenic, because of its mobility relative to the heavy metals, and because it is a human carcinogen, is the element of greatest concern in this analysis. Monitoring wells show that arsenic from the process ponds has migrated into East Helena at concentrations greater than 20 times the federal drinking water standard (maximum contaminant level) of 50 parts per billion. Fortunately, such elevated levels have thus far been found only in shallow groundwater.

Because the affected shallow aquifers are not a source of drinking water in East Helena, there is currently no direct human exposure to arsenic through groundwater. Nonetheless, the potential does exist for human health risk to materialize if someday there is a need to tap into shallow aquifers for drinking water, or if the arsenic migrates into deeper aquifers.

Environmental risks associated with seepage and leakage from the process ponds are already a problem. Seepage from Lower Lake into Prickly Pear Creek adds to existing violations of water quality standards caused by mining leachate entering the creek upstream of the smelter. These water quality standards are intended to protect fish and aquatic wildlife. In addition, seepage from Lower Lake and leakage from the acid plant water treatment facility and the speiss granulating pit and pond have introduced arsenic to the groundwater under East Helena.

The remedial actions presented in this ROD will remove future contact between process fluids and underlying soils and groundwater. Such source removal is a vital first step in reducing the potential human health risks and current environmental risks discussed above. Still, source removal is only the first step. The Comprehensive RI/FS report will address problems associated with

Table 7-2

COSTS AND IMPLEMENTATION TIMES FOR REMEDIATION ALTERNATIVES

Area	Alternative	Capital Cost ($)	Annual O&M Cost ($)	Present Worth ($)	Implementation Time Excluding Smelting of Sediments and Soils (YRS)
Lower Lake	No Action	0	0	0	0
	4A	8,520,600	734,300	12,729,700	5
	4B	8,566,100	756,300	13,113,400	5
	4D	8,520,600	2,577,600	17,749,400	4 [a]
	4E	9,731,200	217,800	12,904,900	4 [a]
	5S	3,538,600	621,600	6,015,300	5
Speiss Granulating Pond and Pit	8B+7E	649,400	6,600	750,900	2 [b]
	8B+7H	590,500	2,200	624,300	2
Acid Plant Water Treatment Facility	11D	1,865,500	5,500	1,958,500	2
	11E	1,746,700	525	1,754,800	2
	11F	1,927,000	33,000	2,859,300	2
Former Thornock Lake	14	19,000	0	19,000	.5

[a] Alternatives 4D and 4E do not involve smelting of excavated sediments.
[b] Remediation of the Speiss Pit may be delayed 12 to 18 months.

be in excess of 100 feet below the ground surface and is overlain by 45 feet of low permeability volcanic ash tuff (Hydrometrics, 1988b). This is probably the same ash tuff unit that underlies the East Helena Area. Costs and implementation time for Alternative 4E are shown in Table 7-2.

7.1.6 ALTERNATIVE 5S

Alternative 5S is essentially the same as Alternative 4A, with one major exception: process waters in Lower Lake would be treated in-place rather than discharged to either Prickly Pear Creek or the POTW, and evaporative processes of the plant would be used to treat the 50 to 70 gpm gain in the process fluid circuit.

Prior to treatment of the process waters, two large tanks would be installed to replace Lower Lake as a process pond as in Alternative 4A, and a lined pond or additional tanks would contain any unexpected runoff. The bottom sediments would be excavated in the same manner as for the key modification of Alternative 4A; that is, excavation would extend to 2 feet below the artificially deposited layer.

The in-place treatment of Lower Lake process waters would involve batch treatment with excess concentrations of ferric chloride to precipitate arsenic and other metals.

Treatment standards for in-place coprecipitation of arsenic and metals have been established by the EPA.[b] The requirements for arsenic, cadmium, copper, lead, and zinc are 0.02, 0.01, 0.004 to 0.008, 0.05, and 0.11 mg/L, respectively. It is required that in-place coprecipitation result in concentrations of metals at or below these requirements.

After treatment, water would be left in place or possibly discharged. Precipitate would accumulate on the pond bottom and would be removed by dredge along with the Lower Pond bottom sediments as described for Alternative 4A. The removed precipitate, along with the bottom sediments, would be dried and smelted, as described for Alternative 4A.

Evaporation processes to reduce gains in the proces circuit would be implemented after the installation of storage tanks and removal of Lower Lake from the main process fluid circuit as described in Alternative 4A. The existing gain in the main process fluid circuit is estimated at 50 to 70 gpm. The following actions would address the main process fluid circuit gains:

1. Removal of groundwater collected in the drainline near the existing ore storage and mixing area from the main process fluid circuit. Pumping collected

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[b]Refer to Chapter 10, "Statutory Determinations," for descriptions of these standards and the basis for their selection.

groundwater from a collection sump into the main process fluid circuit would be terminated and the lower basement of the existing ore storage and mixing area would be allowed to flood (returned to a state of equilibrium with the normal groundwater level). This action would cause the groundwater level to rise approximately 2 feet and reduce gains to the main process circuit by 30 to 40 gpm.

2. Removal of potable water input from freezing prevention bleeders. This action would be accomplished by:

   a. Rerouting potable water bleeders to the sanitary sewer system

   b. Heating trace potable water lines so bleeder lines are no longer necessary

   c. Replacing the existing potable water supply with bottled water

3. Elimination of the remaining gains in the process fluid circuit by existing evaporative processes within the plant or by new methods of evaporation developed using waste heat from the smelter processes are being evaluated. Wastewater from the change house is the remaining source of gains to

the main process circuit. Sources of this waste water are the laundering facilities and personnel showers. An estimated 10 to 20 gpm is generated from these sources.

An additional output to Lower Lake that also needs to be eliminated is the acid plant blowdown coolant water. Flow in this circuit averages about 9 gpm but has occasional short flow peaks (20 minutes) up to 120 gpm.

Cooling towers that are a part of the smelter facility are a potential source of fluid elimination. Consumption of water for this facility varies seasonally from a low of about 5 gpm to a high of about 25 gpm. Additional evaporative devices and methods are currently being investigated.

Costs and implementation time for Alternative 5S are shown in Table 7-2.

7.1.7 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND SEDIMENT CLEANUP OBJECTIVES FOR LOWER LAKE ALTERNATIVES

The Occupational Safety and Health Administration (OSHA) requirements for sediments handling would be the same as for routine smelter operation. Ambient Air Quality Standards native would incur no additional operational or capital costs.

7.2.2 ALTERNATIVE 8B+7E

Alternative 8B+7E involves the following actions:

- Replacement of existing pond with tank and secondary containment facility
- Replacement of existing pit with a new lined facility
- Excavation of contaminated soils

In Alternative 8B+7E, a steel tank with a liner, leak detection system, and secondary containment and recovery capability would replace the existing speiss granulating pond (see Figure 7-2). The tank would be constructed at an elevation to allow gravity draining of the speiss granulating pit. Accumulated sediments in the tank would be periodically suctioned out and reprocessed.

The current speiss granulating pit is constructed of concrete and normally contains water with elevated arsenic and metals concentrations. The pit would be replaced with a watertight facility constructed of concrete with a steel liner. According to Asarco's process engineers, pit

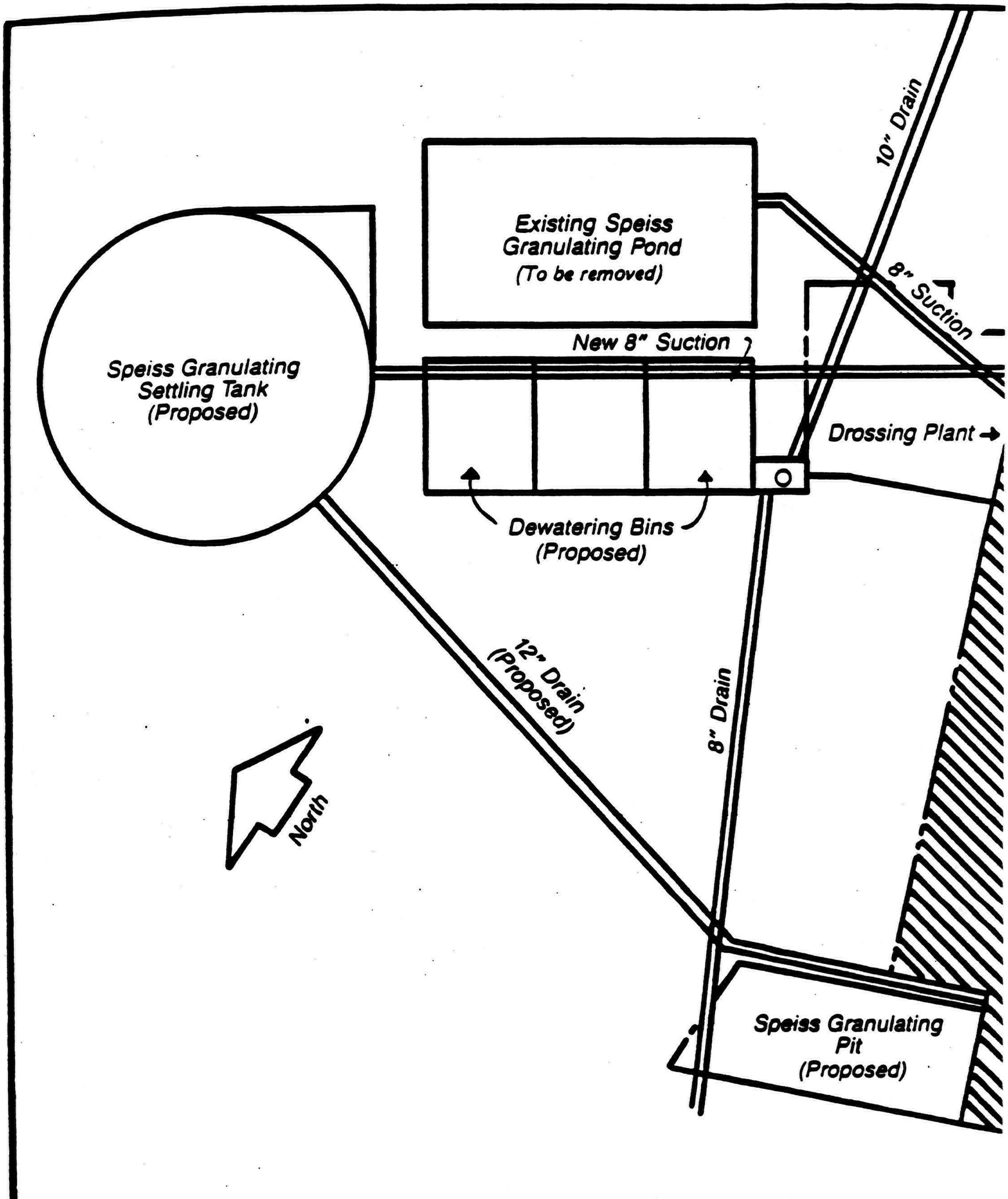

Figure 7-2
Proposed Speiss Granulating and Pond Replacement Facil

replacement may require interruption of plant operations for about 30 days. The pit would be allowed to drain by gravity to the speiss pond when the speiss pit is not in use. A lined secondary leak detection and recovery system would be included.

During construction of these replacement structures, soils underneath and adjacent to the existing pond and pit would be excavated and set aside for smelting later. Prior to smelting, the same precautions against fugitive emissions that are afforded the ore piles would apply to the soils. Large cobbles and boulders would be separated from the soil, washed, and stored onsite, thus reducing the amount of material required for smelting and hence the time required to smelt the soils.

The cleanup objectives based on EP toxicity test data, will be excavation of soils with leachate concentrations exceeding MCLs, or excavation to maximum practical limits (approximately 20 feet). These objectives may require additional soil core sampling at the speiss granulating pond and pit.

Although EP toxicity tests indicate that leachate from soils at a depth of 6 feet may meet federal drinking water standards, excavation to the groundwater table (approximately 20 feet) is recommended to avoid potential conflicts with future construction activities in the area. For example, new structures will be built in the area once excavation cavities are refilled. Excavation to the groundwater table will provide a margin of safety which will decrease the likelihood of a need for future excavation in the area and subsequent disassembly or moving of future structures. Because of the relatively small area of the speiss granulating pond and pit, deep excavation will not require substantially greater cost than excavation to a depth of 6 feet.

Excavation will include a 5-foot buffer zone outside of the perimeter of removed portions of the pond and pit facilities. Although soils outside this zone are potential sources of arsenic and metals to groundwater, 5 feet is considered the practical areal limit associated with the speiss pond and pit installation. Soils outside this zone will be addressed as part of the groundwater and surface soil operable units in the Comprehensive Feasibility Study. Soil would be smelted as described for Lower Lake alternatives. Sediment removal will occur in conjunction with speiss pond and pit replacement.

The estimated volume of material to be removed from the speiss pond and pit area as part of this alternative is 3,700 cubic yards and includes the area 5 feet around the pond and pit perimeter excavated to a depth of approximately 20 feet.

lated to the scrubbers and part is neutralized and pumped to the sinter plant. Areas of primary concern in the acid plant water treatment facility are the dumpsters and the main settling pond which provide gravity settling for blowdown water before it is neutralized and returned. Typical pH of blowdown water prior to neutralization is 1.3 to 1.9. The following are detailed descriptions of remediation alternatives for the acid plant water treatment facility. Within each alternative are individual actions and combinations of actions that together will meet remediation goals. Costs and implementation times for acid plant water treatment facility alternatives are shown in Table 7-2.

7.3.1 NO ACTION

For the No Action alternative, no action would be taken. The existing condition of the main settling pond, dumpster, fluid transport troughs, and the sediment drying area would remain. No additional work would be conducted.

7.3.2 ALTERNATIVE 11F

Alternative 11F would remove the settling pond, dumpster system, and sediment drying area and replace them with an enclosed, aboveground mechanical separation system. The new system would include cyclone separators and a clarifier with tube settlers. The system would include leak detection and secondary containment features. Accumulated sediments would be periodically suctioned out and reprocessed. Existing and proposed sediment-drying areas would be equipped with liners and containment capability.

Presently, all water is neutralized before leaving the treatment plant. The new process would neutralize only water that is pumped to the sinter plant. Scrubber makeup water would not require treatment beyond simple solids removal.

With the existing settling basins and lines removed, excavation of underlying and adjacent soils would proceed. The cleanup objectives, based on EP toxicity test data, will be excavation of soils with leachate concentrations exceeding MCLs, or excavation to maximum practical limits (approximately 20 feet). These objectives may require additional soil core sampling at the acid plant water treatment facility.

Results of past soil leach tests indicate that soils underlying the acid plant water treatment facility should be excavated down to the coarse, groundwater-bearing gravels (approximately 20 feet). This is based on the knowledge that soils under the acid plant water treatment facility exhibit characteristics of EP toxicity throughout the soil profile. The leachate from these tests fails to meet federal drinking water standards, regardless of soil depth. Because of the acidic condition of the soils, lime will be added prior to replacement with fill to reduce mobility of arsenic and metals associated with acidic soils underlying the acid plant water treatment facility.

It is estimated that approximately 6,250 cubic yards of soil would be excavated; however, the actual volume will not be known until additional sampling is conducted in the remedial design phase and actual excavation is underway. Excavated soils that exhibit characteristics of EP toxicity will be temporarily stored within the new ore storage building or in an area that is sufficiently secure to handle hazardous waste. Excavated soils that do not exhibit characteristics of EP toxicity will be temporarily stored alongside the ore piles and treated as ores are treated to prevent fugitive emissions. All excavated soils will be smelted in the smelter process, as described for Lower Lake sediments (Alternative 4A). Large cobbles and boulders would be separated from the soil, washed, and stored onsite, thus reducing the amount of material required for smelting and the time required to smelt the soils.

7.3.3 ALTERNATIVE 11D

Alternative 11D would involve excavation of contaminated soils, as described for Alternative 11F. The existing concrete- or asphalt-lined tank would be replaced with a freestanding steel tank with exposed side walls. The tank would include a leak detection and secondary containment

7.4 ALTERNATIVES FOR FORMER THORNOCK LAKE

In 1986, Thornock Lake was drained and replaced with a steel tank, complete with a liner, leak detection system, and secondary containment and recovery capability. Dry sediments remain in the existing cavity. The EPA has classified these sediments of surface impoundments (including former impoundments) at all lead smelters as hazardous wastes that must be removed and treated or safely disposed.

7.4.1 NO ACTION

There are two alternatives for former Thornock Lake, including No Action. Under the No Action alternative, no further work would be conducted on the sediments in former Thornock Lake. The existing sediment conditions would remain. No direct costs would be incurred if the sediments are left in place.

7.4.2 ALTERNATIVE 14

Alternative 14 consists of excavating the remaining bottom sediments, stockpiling them temporarily, and smelting them. Until the pond was abandoned in 1986, this was the normal procedure. About 100 tons of sediment were reprocessed in the plant from each cleaning. Sediments would be excavated and smelted in the same manner as sediments from Lower Lake. Depth of excavation would be determined as it was described for Alternative 4A (for Lower Lake): excavate to 2 feet beyond the artificially deposited layer of sediments. In the past, sediments were temporarily stockpiled alongside the ore piles before smelting. In this alternative, since these sediments are bottom deposits of a surface impoundments at a lead smelter, the EPA has classified them as a hazardous waste. Therefore, it will be necessary to temporarily stock-pile the excavated sediments in the new ore storage building.

Treating sediments in the smelter process would enable Asarco to recover small amounts of lead and other metals; but more importantly, it will immobilize the remaining arsenic and metals within the slag produced in the process (vitrification). A modification of this alternative is to dispose of the sediments at a licensed hazardous waste facility (refer to Alternatives 4D and 4E for Lower Lake). The costs and implementation time for Alternative 14 are shown in Table 7-2.

7.4.3 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs) AND THE SEDIMENT CLEANUP OBJECTIVES FOR FORMER THORNOCK LAKE ALTERNATIVES

Ambient Air Quality Standards for smelting sediments, the same as for smelting ore, are expected to be met once the new State Implementation Plan for reducing emissions takes effect.

The sediment cleanup objective for sediments in former Thornock Lake is the same as that for Lower Lake. The depth of sediment removal will be 2 feet beyond the lower limit of the artificially deposited sediment layer. This alternative is not expected to interfere with future remedial actions in the area.

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- In-place co-precipitation of Lower Lake process waters

- Remove sediments by dredge, dragline, or industrial vacuum

- Dry sediments on drying pad

- Smelt sediments in the smelter process

Since the in-place treatment of process waters has not seen proven on a large scale, a contingency remedy, Alternative 4A, has been selected for implementation in case implementation of the selected alternative fails to result in achieving ARARs (or prescribed standards). Alternative 4A is identical to Alternative 5S, except for the way in which process waters are treated. Alternative 4A involves pretreatment of process waters followed by discharge to the POTW.

Preparation for the implementation of the contingency remedy, Alternative 4A, should commence immediately, so that remedial actions will not be delayed if the selected remedy, Alternative 5S, does not meet prescribed standards for in-place treatment. The EPA, state, and local community should follow the federal effluent guidelines (40 CFR 421.72, in part) in developing a community pretreatment program, including development of pretreatment standards, for the contaminants of concern.

Actions for both alternatives are described in detail in Chapter 7. The volumes of contaminants addressed by these alternatives are also described in Chapter 7. The time required to implement Alternatives 4A or 5S will be 5 years, excluding smelting time.

Smelting of Lower Lake sediments will take precedence over smelting sediments and soils from other areas. However, during the time it takes to prepare Lower Lake sediments for smelting, soils and sediments from other areas should be smelted. The materials requiring smelting are, in order of decreasing priority: Lower Lake sediments, former Thornock Lake sediments, soils from the acid plant area, and soils from the speiss granulating area. It is expected to take 12 to 15 years to smelt all the excavated soils and sediments.

For the selected remedy, Alternative 5S, the EPA will require a treatability study plan before any treatability study tests will be done. As soon as possible, Asarco will submit to the EPA a treatability study work plan and, by June 15, 1990, a treatability study report. The report should document whether or not in-place co-precipitation of Lower Lake process waters is expected to meet the prescribed standards presented in Chapters 7 and 10.

9.2 SPEISS GRANULATING POND AND PIT

The selected remedy for the speiss granulating pond and pit, Alternative 8B+7E, includes the following actions:

- Excavate soils
- Smelt soils in the smelter process
- Replace existing pond with tank and secondary containment facility
- Replace existing pit with a new lined facility

Descriptions of these actions and of the volumes of material addressed by this alternative are presented in Chapter 7. Capital and O&M costs are shown in Table 7-2. The time required to implement Alternative 8B+7E will be 2 years, not including the smelting of excavated soils and complete remediation of the speiss pit. The EPA may grant an additional 12 to 18 months to completely replace the speiss granulating pit and excavate the underlying soils. Although remediation of the speiss pit may be deferred to 1992, leakage from the speiss granulating pit must be stopped immediately by use of a liner or other comparable technology. Smelting of excavated soils may take up to 12 to 15 years. Soils excavated from the speiss granulating

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pond and pit will be smelted after sediments and soils from all other areas are smelted.

The cleanup objectives based on EP toxicity test data, will be excavation of soils with leachate concentrations exceeding MCLs, or excavation to maximum practical limits (approximately 20 feet). These objectives will require additional soil core sampling at the speiss granulating pond and pit.

9.3 ACID PLANT WATER TREATMENT FACILITY

The selected remedy for the acid plant water treatment facility, Alternative 11F, includes the following actions:

- Replace existing pond and settling system with closed circuit filtration treatment system
- Excavate contaminated soils
- Smelt contaminated soils in the smelter process, thus returning metals to the process by which they were generated.

Descriptions of these actions and of the volumes of material addressed by this alternative are presented in Chapter 7. Capital and O&M costs are shown in Table 7-2. The time required to implement Alternative 11F will be 1 year, not ıcluding the time required for smelting excavated soils. ›ils excavated from the acid plant water treatment facility ill be smelted after smelting sediments excavated from ower Lake and former Thornock Lake, and before smelting oils excavated from the speiss granulating pond and pit.

The cleanup objectives, based on EP toxicity test data, will be excavation of soils with leachate concentrations exceeding MCLs, or excavation to maximum practical limits (approximately 20 feet). These objectives will require additional soil core sampling of the acid plant water treatment facility.

9.4 FORMER THORNOCK LAKE

The selected remedy for former Thornock Lake, Alternative 14, includes the following actions:

- Excavate sediments
- Smelt sediments in smelter process

Descriptions of these actions and of the volumes of material addressed by this alternative are presented in Chapter 7. Capital and O&M costs are shown in Table 7-2. The time required for excavation will be 6 months.

10.3 COST-EFFECTIVENESS

The selected remedial alternatives are cost-effective options for cleanup of the process ponds operable unit. This determination is based on the cost and overall effectiveness of the selected remedies when viewed in light of the cost and overall effectiveness of other alternatives. A discussion of the cost-effectiveness for selected alternatives for each area follows.

10.3.1 LOWER LAKE

The selected alternative for remediation of Lower Lake, Alternative 5S, includes in-place treatment of Lower Lake process water. This alternative is attractive because of the relatively low cost, approximately $6 million (present worth). However, in-place treatment of process waters is an unproven technology on as large a scale as would occur herein and may not meet remediation goals. Sediments would be excavated and disposed in the smelter process. The contingency remedy for Lower Lake is Alternative 4A which includes replacement of Lower Lake, excavation and smelting of sediments, pretreatment of process fluids, and further treatment of process fluids in the East Helena POTW.

The principal difference between alternatives is the proposed means of sediment disposal: smelting the sediments, disposal in an offsite hazardous waste disposal facility, and disposal in a proposed new hazardous waste disposal facility in the East Helena area. Both the selected and contingency remedies include treatment and disposal of sediments in the smelter process. This process allows recovery of trace metals and reduction of contaminant mobility and volume. The disposal of sediments in a proposed RCRA landfill to be constructed in the East Helena area was of comparable cost, approximately $12 million, but does not include treatment as a principal element and does not reduce the volume of contaminants. The disposal in an offsite hazardous waste disposal facility was determined to be approximately $5 million more expensive than disposal in a new hazardous waste disposal facility in the East Helena area.

Other variations on alternatives for Lower Lake include the means of disposal of Lower Lake fluids. Pretreatment of fluids followed by treatment at the East Helena Sewage Treatment works may be less cost-effective than in-place co-precipitation, but more cost-effective than disposal to Prickly Pear Creek. Disposal to the POTW would cost approximately $1 million less than disposal of process fluids to Prickly Pear Creek. The extra costs involved with disposal to Prickly Pear Creek arise from the more stringent pretreatment requirements to be met prior to stream discharge.

10.3.2 SPEISS GRANULATING POND AND PIT

The selected alternative for the speiss granulating pond and pit, Alternative 8B+7E, includes replacing the speiss granulating pond and pit, and excavation and smelting of soils. Replacement of the pond and pit would offer more protectiveness than Alternative 8B+7H, which would replace the pond and repair the pit. The difference in cost is approximately $130,000.

10.3.3 ACID PLANT WATER TREATMENT FACILITY

The preferred alternative for the acid plant water treatment facility, Alternative 11F, includes replacing the settling dumpsters and pond with a closed-circuit filtration system, and excavating and smelting soils. This alternative offers more protection than Alternative 11E, which involves repair of the pond (instead of replacement). Alternative 11F is approximately $1 million more expensive than Alternative 11E. Alternative 11F would also be more protective than Alternative 11D, which involves replacement of the settling dumpsters with new settling dumpsters and replacement of the pond with a steel tank. Alternative 11D would cost less than Alternative 11F (approximately $2 million versus approximately $2.9 million). Alternative 11F, the selected remedial action, includes a closed-circuit filtration system and, although it costs more, it offers more tection for the underlying groundwater than the other ernatives.

3.4 FORMER THORNOCK LAKE

nce only one alternative was considered for remediation of rmer Thornock Lake, a cost-effectiveness evaluation was necessary. However, several means of sediment disposal re considered for this alternative. As discussed for the wer Lake alternatives, smelting the sediments was deter-ined to be the most protective and cost-effective means of isposing of the sediments.

10.4 UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

The selected remedies satisfy the statutory preference for utilization of permanent solutions and alternative treatment technologies. Treatment is a principal element of the alternatives selected for all areas. They are permanent solutions in that they will decrease the concentrations of contamination sources. Selected alternatives for all areas include treatment or recycling of soils and sediments in the smelter process. The process waters of Lower Lake will also be treated. The selected alternative includes in-place treatment of process waters by co-precipitation. The

11.2 CHANGE IN SELECTED REMEDY FOR LOWER LAKE

The EPA has determined, based on information received during the comment period, that the preferred alternative for Lower Lake, Alternative 4A, no longer provides the most appropriate balance of tradeoffs among the alternatives with respect to the evaluation criteria. Information available to the EPA has suggested that another alternative from the Proposed Plan and RI/FS report, Alternative 5S, provides the best balance of tradeoffs. As indicated in the Responsiveness Summary, the EPA has acknowledged, in both the Proposed Plan and the public meeting, that Alternative 5S should be re-evaluated if new and relevant information became available. In light of Asarco's September 20, 1989, proposal for pilot-scale tests, in light of requests by concerned residents and local government officials, and in light of independent assessments by the U.S. Bureau of Mines and the Montana College of Mineral Science and Technology, the EPA has determined that the in situ treatment method using ferric chloride is the preferred method to be applied in this remedy. The public was apprised previously that Alternative 5S might be selected as the remedy; thus, the public had adequate opportunity to review and comment on it.

If pilot-scale tests of in situ co-precipitation methods prove this innovative technology to be ineffective in terms of treating Lower Lake waters to prescribed standards, the EPA will require construction of a water treatment facility.

Such a facility will be designed to remove metals and arsenic to yet-to-be-determined levels for discharge to the East Helena publicly-owned wastewater treatment plant.

11.3 CHANGE IN IMPLEMENTATION TIMES FOR SELECTED ALTERNATIVES

The EPA has made a change to a component of the selected alternatives that has resulted in an alteration to the scope of the remedy. The overall waste management approach represented by the alternatives has not been affected. In the Proposed Plan, the implementation times for Alternatives 5S, 8B+7E, 11F, and 14 were 4, 2, 1, and 0.5 years, respectively. However, these time estimates did not account for:

- The recommended depths of excavation
- The additive effects of smelting times

The depths of excavation recommended by the EPA in the Proposed Plan were greater than those which Asarco used to calculate implementation times. Also, the implementation times presented in the FS and the Proposed Plan did not account for the slow rate of smelting excavated sediments and soils. The smelting of all excavated soils and sediments may take longer than anticipated. The estimated implementation times for alternatives in this ROD are presented in the following subsections.

11.3.1 LOWER LAKE

In the FS, the time for remediation of Lower Lake under Alternative 5S is 4 years, assuming an average excavation depth of 3 feet. The EPA has decided, based on EP toxicity data and other data from the RI, that excavation to an average of 4 feet would provide greater protection to the groundwater. The EPA has determined that 5 years should provide ample time for remediation of Lower Lake, considering the increase in excavation depth. Smelting of Lower Lake sediments will take precedence over smelting sediments and soils from other areas. However, during the time it takes to prepare Lower Lake sediments for smelting, soils and sediments from other areas should be smelted. The materials requiring smelting are, in order of decreasing priority: Lower Lake sediments, former Thornock Lake sediments, soils from the acid plant area, and soils from the speiss granulating area.

11.3.2 SPEISS GRANULATING POND AND PIT

In the FS, the time required for remediation of the speiss granulating area under Alternative 8B+7E is 2 years, assuming an excavation depth of 6 feet. The EPA has decided, based on EP toxicity data, that excavation will be as deep as 20 feet, or to the practical limit of excavation, to provide greater protection to the groundwater. The EPA has determined that remediation of the speiss granulating pond, except for smelting the excavated soils, should take 2 years. Remediation of the speiss pit may require an additional 12 to 18 months. Smelting of excavated soils may take 12 to 15 years, considering that soils from this area have low priority for smelting.

11.3.3 ACID PLANT WATER TREATMENT FACILITY

In the FS, the time required for remediation of the acid plant water treatment facility under Alternative 11F is 1 year, assuming an excavation depth of 5 feet. The EPA has decided, based on EP toxicity data, that excavation will be as deep as 20 feet, or to the practical limit of excavation, to provide greater protection to the groundwater. The implementation time for remediation excluding the time for smelting soils should be 2 years. Soils will be smelted after all excavated sediments from Lower Lake and former Thornock Lake have been smelted.

11.3.4 FORMER THORNOCK LAKE

In the FS, the time required for remediation of former Thornock Lake under Alternative 14 is 6 months, assuming excavation to 5 feet below the surface. Based on RI data, the EPA has decided that excavation will be 2 feet below the layer of artificially-deposited sediments to provide greater protection to the groundwater. The data from the RI indicate that the average depth of the artificially deposited layer is 3 feet. Therefore, the EPA concurs with the estimated implementation time of 6 months, excluding the time for smelting sediments. The excavated sediments can be smelted during the initial stages of implementing remediation of Lower Lake, until Lower Lake sediments are ready to smelt. Then, the smelting of Lower Lake sediments would take precedence, with Thornock Lake sediments second in priority.

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Reference 2

(Executive Summary of the Draft Comprehensive RI/FS, East Helena Smelter Site)

Surface Water Systems and Hydrology

The Asarco plant is adjacent to Prickly Pear Creek, which flows to the north through the community of East Helena, the Helena Valley, and into Lake Helena. Other major surface water features include: Upper Lake, located south of the plant; Lower Lake, process pond located immediately north of Upper Lake; and Wilson Ditch, an irrigation diversion from Upper Lake. The plant and the East Helena community are underlain by unconsolidated alluvium deposited by ancestral Prickly Pear Creek. The alluvial deposits have variable permeabilities and consist of layers and mixtures of cobbles, gravel, sand, silt and clay. Underlying the alluvium, and present in exposures west and north of the plant and the East Helena community are fine-grained Tertiary volcanic ash tuff deposits, which have low permeabilities, and which have weathered to a fine clay in some locations.

SCOPE OF INVESTIGATION ACTIVITIES

Process Fluid Circuits

The process pond sub-unit remedial investigation is included in the Process Pond RI/FS report and is not discussed here. Investigation activities associated with the Process Circuit sub-unit included: identification of main plant process circuits; water sample collection of circuit process fluids; and pressure line and drain line leakage tests.

Groundwater

The groundwater investigation included: collection of stratigraphic samples from 63 soil core drill holes and 10 test pits; drilling and construction of 51 monitoring wells and piezometers; groundwater sampling and analysis of 41 monitoring wells and 33 privately owned wells; and aquifer testing of 38 monitoring wells.

Surface Soil/Surface Water

The surface soil/surface water remedial investigation included: collection and analysis of 26 soils samples from within the plant site; collection and analysis of 24 East Helena soil samples to supplement soil data collected by EPA during the Phase I soils RI, and the CDC/MDHES Child Lead Study; flow measurement, water sampling and analysis of Prickly Pear Creek, Upper Lake and Wilson Ditch; instrumentation of 6 monitoring wells and 1 station on Prickly Pear Creek to evaluate surface water/groundwater interrelationships; plant site surface water drainage mapping and double ring infiltrometer test; collection and analysis of vegetable samples from both residential gardens and Helena Valley grains; sampling and analysis of Helena Valley cattle; sampling and analysis of fish in Prickly Pear Creek and Lake Helena; and a waterfowl/sediment comparison literature review, and a biological inventory for Upper Lake.

Slag Pile

The slag pile investigation included: slag infiltration test basin construction; infiltration water sampling and analysis; slag material sampling and analysis; and air quality sampling and analysis.

Ore Storage Area

The Ore Storage Area investigation was included as part of plant site groundwater and surface soil/surface water investigation activities. Air quality samples were also collected and analyzed.

RESULTS OF THE INVESTIGATION

Process Fluid Circuits

Pressure line testing and drain line flow measurement and inspection indicate leakage occurs from these process fluid lines. Generally, water from the process fluid circuits are sodium-sulfate type, and have moderately high concentrations of TDS, metals and arsenic. Concentrations of TDS, metals and arsenic are variable over time. The process fluids are used in a variety of ore processing operations in the plant, and for dust suppression in plant processing and ore storage areas.

Groundwater

Water quality sampling showed shallow groundwater (upper 10 feet of saturation) under the plant and to some extent under East Helena has elevated arsenic concentrations. Water samples from the next water bearing zone underlying the shallow aquifer do not have elevated arsenic concentrations. Arsenic concentrations in private wells were generally low and were below MCLs for arsenic. All but two private wells are no longer used as domestic water supplies and have been replaced with city water. The two private wells that remain in use have little potential to be impacted by groundwater.

A northwest trending, relatively high concentration arsenic plume has been delineated in the shallow alluvial groundwater system on the plant site. Primary sources of this plume include the speiss granulating pond and pit, the acid plant water treatment facility and its associated sediment drying areas. Losses from the process fluid circuits also contribute to this arsenic plume. This multi-source plume is superimposed on a relatively broader, lower concentration arsenic plume that is associated with Lower Lake. The lower concentration plume also extends to the north and northwest, in the general direction of groundwater flow. Arsenic concentrations are significantly reduced in East Helena and are near or below MCLs (0.05 mg/l) at the north edge of the community. Calculated groundwater flow, and groundwater and stratigraphic geochemical analyses indicate geochemical and physical reactions with arsenic are attenuating the arsenic plumes.

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Surface Soils/Surface Water

Plant Site Soils

Plant site soil sample analyses indicate the highest metals concentrations are in areas associated with storage, loading and handling of ore. On-going dust management programs are implemented to reduce plant site air-borne dust as well as reduce off-plant dust migration.

Residential Soils

Forty-two surface soil samples were collected during 1984 and 1987 in residential East Helena. Fifteen metals were analyzed and lead and cadmium concentrations were the most elevated. Residential soil samples also were collected in 1983 by CDC (Center for Disease Control) and MDHES (Montana Department of Health and Environmental Sciences). Lead and other metals concentrations generally decrease with increased distance from the plant.

Helena Valley Soils

Helena Valley soils were also sampled in 1984 as part of the EPA Phase I Soil RI; this data indicates fields east of the plant have the highest metals concentrations.

Surface Water - Prickly Pear Creek, Upper Lake, Wilson Ditch, and Overland Runoff

Surface water and bottom sediment samples were collected from Prickly Pear Creek, Upper Lake, and Wilson Ditch. Prickly Pear Creek water quality upstream of the plant is generally good, but contains some arsenic and metals as a result of upstream mining and land disturbances. Lower Lake, a process pond located adjacent to Prickly Pear Creek, is a source of minor arsenic concentration and load increases to the stream (remediation of Lower Lake is addressed in the Process Pond RI/FS). With the exception of impacts from Lower Lake, measurable arsenic or metals concentration increases in Prickly Pear Creek were not observed. A portion of the creek is diverted upstream of the plant to Upper Lake for plant use and to supply 2 to 3.5 cfs of irrigation water to Wilson Ditch. The water quality of Upper Lake and Wilson Ditch is essentially the same as Prickly Pear Creek above the plant. Prickly Pear Creek, Upper Lake and Wilson Ditch all have elevated metals concentrations in bottom sediment with Wilson Ditch having the highest concentrations and Prickly Pear Creek the lowest.

Overland runoff from short, intense summer thunderstorms were collected at locations inside and outside the plant site. All samples had considerable suspended sediment and elevated concentrations of metals and arsenic, with higher concentrations within the plant site. Plant site

1.1.4 Water Resources

The Helena Valley is part of the Missouri River basin. Several major reservoirs, including Canyon Ferry Lake, Hauser Lake, Holter Lake and Lake Helena are located near the northern extent of the Helena Valley and are part of the Missouri River system (Figure 1-1-1). Major streams that enter the Helena Valley, including Prickly Pear Creek, drain into Lake Helena.

Groundwater in the Helena Valley generally moves north and east toward Lake Helena, which is a discharge point for the valley groundwater system (Wilke and Coffin, 1973). Groundwater recharge in the Helena Valley comes from precipitation on the valley floor and surrounding mountains and from streams and irrigation canals that cross the valley floor. These streams and canals generally lose significant quantities of surface water into the underlying groundwater system.

In the vicinity of the East Helena Plant, groundwater in the unconsolidated Quaternary deposits generally flows to the north and receives recharge from Prickly Pear Creek as the stream enters the valley near East Helena (Figure 1-1-1).

Surface water resources in the East Helena Plant area include Prickly Pear Creek and several small ponds and lakes (Figure 1-1-5). Prickly Pear Creek flows along the east and north boundaries of the East Helena Plant. This perennial stream has its headwaters in the Elkhorn and Boulder Mountains about 30 miles south and west of the plant. Prickly Pear Creek drains into Lake Helena approximately seven miles north of the plant site.

Other surface water features at the East Helena Plant site include Upper Lake, Lower Lake and Wilson Ditch. Lower Lake was used for collection and storage of process waters. Upper Lake receives flow from a diversion on Prickly Pear Creek about one-half mile south of the plant. Upper Lake provides plant make-up water and supplies irrigation water to Wilson Ditch. Flow into Wilson Ditch is controlled with a headgate at Upper Lake; water enters an underground pipeline and travels a distance of

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Reference 3

(Superfund Program Fact Sheet, East Helena Smelter Site)

0230961

EPA Region VIII Superfund Program Fact Sheet
Montana Department of Health and Environmental Sciences

East Helena Smelter Site — April 1989

Phase II Studies of Vegetation, Livestock, Soils and Ground Water

THIS FACT SHEET PROVIDES INFORMATION ABOUT:

- Arsenic, cadmium, and lead in garden vegetables, grain, livestock, residential soils, Wilson irrigation ditch, and ground water
- Public health advisories
- Process ponds feasibility study
- Future Superfund activities and opportunities for public involvement

HISTORY OF SITE ACTIVITIES:

- Site listed on National Priorities List in 1983
- Phase I studies (preliminary investigations of soils, vegetation, livestock, and surface and ground water throughout the Helena Valley) conducted from 1984 to 1987
- Phase II studies (final investigations) conducted from 1987 to 1989
- Feasibility studies (evaluation of cleanup alternatives) underway
- Records of Decision (plans of action) expected in 1989 and 1990

INTRODUCTION

Superfund studies conducted from 1984-1987 indicated that most of the Helena Valley (approximately 100 square miles) has been affected to at least some degree by emissions from the ASARCO lead smelter at East Helena. Arsenic and several metals are present at elevated levels in the valley's soils, vegetation, and water. These Phase I studies also revealed that the highest concentrations of these elements are centered at the smelter site and adjacent areas, including the city of East Helena.

Because these elements can be harmful to both public health and the environment, more detailed studies were conducted from 1987 to 1989. The Phase II studies focused on the livestock, vegetation, and soils located within approximately two and one-half miles of the smelter, and on ground water underlying areas within about one-half mile of the smelter (See the map, Figure 1).

This fact sheet summarizes the findings of the Phase II studies.

GARDEN VEGETABLES

In the summer of 1987, ASARCO's consultants collected lettuce, beet greens, chard, carrots, potatoes, parsley and tomatoes from sixteen gardens in the East Helena area and one garden at Townsend for comparison. The samples were analyzed for arsenic and metals including cadmium, copper, mercury, manganese, lead, antimony, selenium, thallium, and zinc.

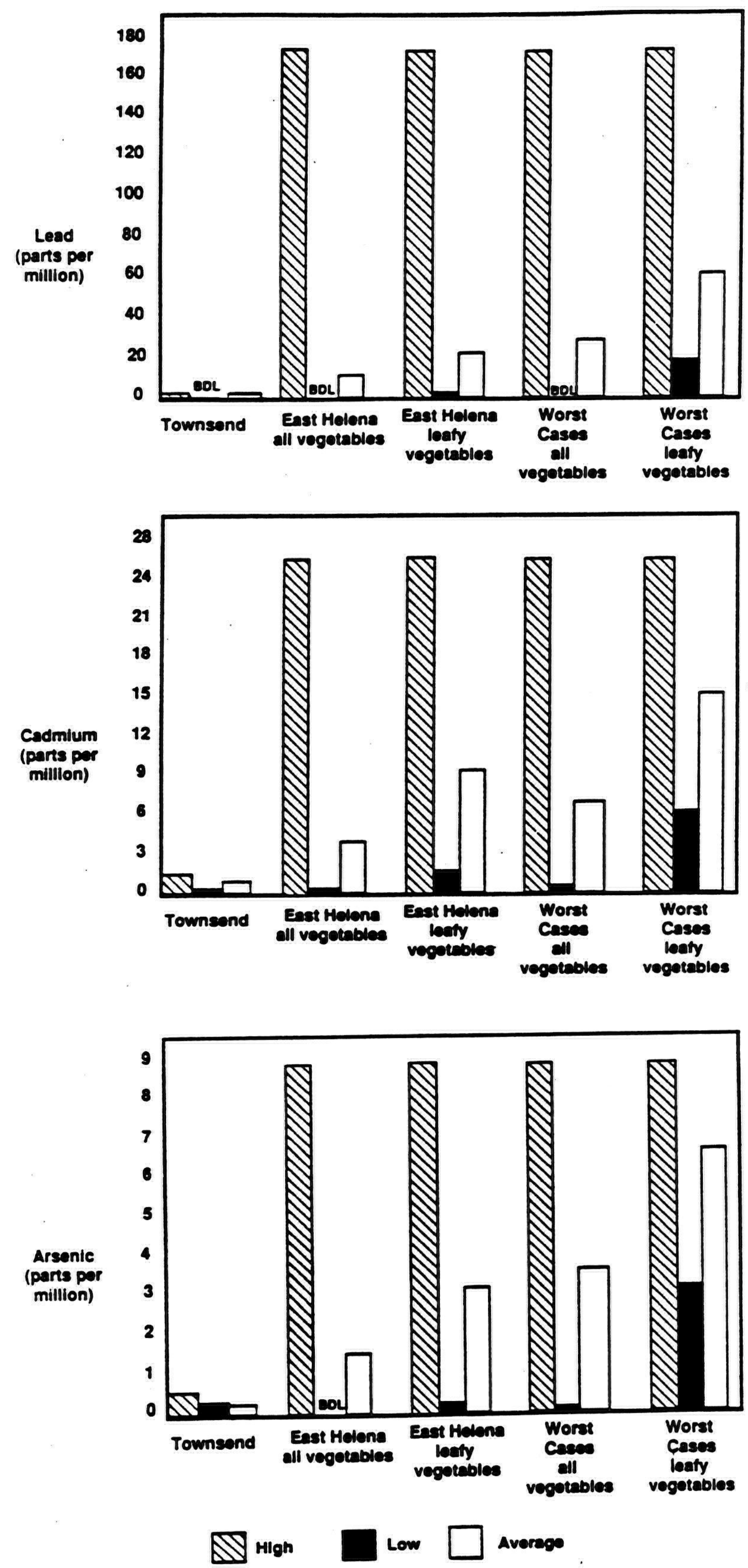
The results of the laboratory analysis revealed low concentrations of arsenic and metals in the vegetables collected from the Townsend garden (See Figure 2). In fact, Townsend vegetables are typical of vegetables produced throughout the country.

The analysis of vegetables collected from gardens within or near East Helena revealed higher concentrations of arsenic, cadmium and lead in the vegetables from virtually every garden sampled, as compared to the Townsend (background) vegetables. As shown in Figure 2, the average of all samples from East Helena area gardens have approximately five and one-half times as much arsenic, six times as much cadmium, and seventeen times as much lead as the average of all vegetables from the background samples.

The greatest concentrations of arsenic, cadmium, and lead in vegetable samples from the East Helena area were found in the leafy vegetables, such as lettuce, beet greens, and chard. Figure 2 also shows East Helena area leafy vegetables have, on average, approximately eleven times as much lead as background samples used for comparison.

A "worst case" situation was also examined. Laboratory results for three of the most highly contaminated gardens were considered separately from all other results. Leafy vegetables from those three gardens

Figure 2.
Levels of Selected Elements in Garden Vegetables



BDL - Below detection limit of instrument used in lab analysis

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have approximately 25 times as much arsenic, 20 times as much cadmium and 100 times as much lead as the Townsend vegetables.

Four of the gardens sampled in the East Helena area were located approximately one and one-half to two and one-half miles from the smelter (Map Area 2). The remaining gardens sampled were located within the city of East Helena itself, or within one mile of the smelter (Map Area 1). The concentrations of arsenic, cadmium and lead are greatest near the smelter, which is consistent with other Superfund study results. However, it is important to note that although the average concentrations of arsenic, cadmium, and lead are greatest near the smelter, high levels of these substances can be found elsewhere. For example, the highest lead concentrations found in the area were in lettuce grown just over a mile from the smelter.

Information from a large number of people who responded to a questionnaire last year indicates that roughly fifty percent of East Helena area residents maintain a vegetable garden of some sort. It is also apparent that many families are preserving their vegetables, thus depending on their garden for a significant portion of their vegetable diet year around.

EPA and MDHES made some important recommendations to residents about their garden vegetables in a September 1988 newsletter. These recommendations should be carefully considered again as preparations begin for Spring 1989 planting. The recommendations are:

1) Limit or eliminate homegrown leafy vegetables from your diet. This includes lettuce, spinach, cabbage, Swiss chard, rhubarb, and other similar vegetables. Leafy vegetables take up cadmium as they would nutrients, and they absorb lead into the outer surface of their leaves, so neither of these elements can be washed off.

2) Peel and wash thoroughly all root vegetables. This is particularly necessary for potatoes, but it also applies to carrots, turnips, yams, sweet potatoes, and other similar vegetables.

3) The remaining vegetables, such as peas, beans, corn, cucumbers and squash, and true fruits, such as apples, berries, melons and tomatoes, which are often preserved or frozen, as well as eaten fresh, should be washed well and prepared in the usual, prudent manner. The fruiting bodies of plants (seed-containing parts) do not readily take up metals from the soil; however, their outer surfaces can become coated with dust that may contain arsenic, cadmium, and lead.

In August 1987, ASARCO's consultants collected 45 wheatgrain samples from various fields within the Helena Valley study area. In addition, three samples were collected from outside the study area in fields east of Canyon Ferry Lake. The information collected by ASARCO has been combined with results of the Helena Valley wheat studies conducted by EPA in 1984. This information, in conjunction with a survey of commercial crop use, will enable ASARCO, EPA, and MDHES to determine whether health risks exist for people who consume grain grown near the smelter. The results of these studies indicate that some grain fields in the Helena Valley are producing wheat crops with elevated levels of arsenic, cadmium, and lead compared to the grain samples collected east of Canyon Ferry Lake.

ASARCO also conducted a survey to define the local production, marketing, and consumption of cereal grains grown in the Helena Valley. Five households were identified in the Helena Valley that consume local grain products. EPA and MDHES will evaluate and make recommendations on the effects of consuming metals in locally grown grains.

LIVESTOCK

In December 1987, ASARCO and its consultants purchased and slaughtered twelve cattle from two different herds raised near the smelter, and six other animals from a ranch near Townsend. Samples of beef muscle, liver, and kidney were analyzed for arsenic, cadmium, lead, and zinc to help determine the risk of eating beef from cattle raised near the smelter.

Concentrations of arsenic, lead, and zinc in the tissues of cattle raised in the Helena Valley were not markedly different from those found in the Townsend area cattle. Levels of these three elements found in the Helena Valley cattle and Townsend area cattle also did not differ significantly when compared with test results of cattle from throughout the United States and Canada.

In contrast, cadmium concentrations were significantly elevated in the kidneys and slightly elevated in the livers of both the Helena Valley and Townsend area cattle in comparison with national studies.

The U.S. Department of Agriculture (USDA) has collected information on test results of metals levels in kidney, liver, and muscle tissue in over 2,100 cattle. Cadmium concentrations in cattle kidneys represented in this national survey averaged 0.3 ppm, and ranged from 0.01 to 7.82 ppm. In comparison, the test animals from East Helena averaged about 6.0 ppm, with a range of 0.6 ppm to 21.6 ppm, and two of four test animals from the Townsend area had slightly more than 10 ppm cadmium in their kidneys.

Cattle accumulate cadmium in their kidneys and liver with age. Because the test animals from Townsend were over ten years old, normal cadmium levels in the soils and feed there probably accumulated in the animals over time. Yet, all of the test animals, from both East Helena and Townsend appeared healthy.

Information collected by the World Health Organization on the effects of cadmium levels in humans shows that consumption of excessive cadmium over time can cause kidney dysfunction or failure. As in other mammals, the kidneys are the human organ most susceptible to cadmium. The World Health Organization recommends avoiding kidney or liver in excess of 0.5 ppm cadmium, and muscle tissue in excess of 1.0 ppm cadmium. Until the risk assessment is completed, EPA and MDHES advise people to avoid eating kidneys from cattle raised in the East Helena area.

All of the muscle tissue tested from the East Helena and Townsend cattle was considerably below 1.0 ppm cadmium. In fact, none of the muscle tissue exceeded 0.04 ppm.

RESIDENTIAL SOILS

ASARCO's consultants also collected surface soil samples from 28 yards and play areas within East Helena in the fall of 1987. The samples were tested for arsenic, cadmium, lead and other harmful elements. The results of ASARCO's soil sampling effort were similar to two earlier soil sampling studies.

The first soil study was done in 1983 by a team of researchers from the National Centers for Disease Control of Atlanta (CDC) and the Montana Department of Health and Environmental Sciences (MDHES). The second soil study was done for EPA by Montana State University in 1984 and 1985. The three soil sampling studies together provide useful information on approximately 275 separate sites within about two miles of the smelter, and with an emphasis on residential areas.

Arsenic, cadmium, and lead in the soil are the elements of concern to the EPA and MDHES. Results of studies at East Helena indicate that, of these three elements, lead is the most prevalent and dangerous. Roughly half of the yards and play areas sampled within East Helena have more than 1,000 parts per million (ppm) lead in the surface soil. Many of these were found to have more than 2,000 ppm lead, and some are in the range of 3,000-7,000 ppm.

The National Centers for Disease Control has been studying the problem of lead in the environment and its effects on human health for many years. The CDC has identified 500-1,000 ppm as a range of concern because of the potential for children coming into direct contact with soils containing levels of lead in or above that range. EPA has ordered cleanup actions at a number of other Superfund sites where soil lead levels exceed 1,000 ppm.

Studies of lead in the blood of children nationwide, particularly those children from one to six years old, led the CDC more than a decade ago to establish an "action level," or a level above which medical treatment for lead poisoning is advised. In 1974, the action level was 40 micrograms of lead per one deciliter of blood. A few years later, the CDC reduced the action level to 30 micrograms per deciliter. In 1985, it was reduced again to 25 micrograms per deciliter. In March 1986, EPA's Clean Air Scientific Advisory Committee recommended lowering the blood lead action level further, from 25 micrograms per deciliter to nine micrograms per deciliter. Decisions by CDC to reduce the action level have been influenced by mounting evidence that lead can result in serious and irreversible intellectual impairment in children with only small amounts of lead in their systems.

The results of blood lead studies of East Helena children can be viewed both positively and negatively. On one hand, a definite decrease in blood lead has been observed. Comparing the 1975 study with the 1983 study, fewer children exceed the current lead action level established by the Centers for Disease Control. On the other hand, East Helena children still have about twice as much lead in their blood as the national average for children. According to the 1983 study, approximately 35 percent of the East Helena children had blood lead above 15 micrograms per deciliter.

WILSON IRRIGATION DITCH

During Phase II soil studies, EPA, DHES, and ASARCO identified significantly elevated levels of arsenic in the soils and sediments of the Wilson irrigation ditch. The ditch begins at the east edge of the smelter, passes underneath the smelter site, and runs open through the yards of residences in the Manlove subdivision (see map).

Children have been observed playing and riding bicycles along Wilson Ditch, particularly when it is dry. Given the levels of arsenic, lead, and cadmium found along the ditch, parents are advised to keep their children away from it. The levels of elements present here are high but not acutely toxic. In other words, if a child playing on the ditch accidentally ingests a small amount of soil, or inhales some dust, the child will not be poisoned. Repeated contact over months or years, however, may result in increased health risks for that child.

GROUND WATER AND PROCESS PONDS

During Phase II ground water studies, fifteen new monitoring wells were added to the 30 wells drilled during Phase I. The newer monitoring wells showed elevated arsenic levels in the shallow ground water underlying portions of East Helena.

One well, located east of Prickly Pear Creek in Memorial Park, has had arsenic levels over one part per million. That is 20 times the maximum level of arsenic EPA considers acceptable for community and municipal water supplies. Two other shallow monitoring wells, in the residential area west of Prickly Pear Creek, show similarly high levels of arsenic. It is important to note that these are test wells. No private wells are located in the areas found to have these high arsenic concentrations.

Most East Helena residents receive their water from a municipal water system. A few residents continue to obtain water from private domestic wells. Those who have retained their wells, or are planning to drill a well, are advised to have their water tested regularly, particularly if the well is located within one-half mile of the smelter.

Phase I and Phase II ground water studies conducted by ASARCO revealed four primary sources of the arsenic that has migrated into East Helena's shallow ground water. The lower process pond, Thornock Lake, the Speiss granulating area, and the acid plant water treatment facility have all contributed to the arsenic that has permeated the soils and ground water underlying the smelter site, and migrated with the natural, northward movement of ground water.

The urgency of this problem prompted ASARCO to make it a priority among the other problems at the site. ASARCO just completed a draft feasibility study of the four process ponds. The feasibility study considers alternatives for cleaning up the existing contamination at the process ponds.

EPA and MDHES have conducted a preliminary review of ASARCO's process ponds feasibility study report and agree with ASARCO that early measures should be taken to clean up these primary sources of arsenic and metals. The report will be released for public review when it is completed.

FUTURE ACTIVITIES AND OPPORTUNITIES FOR PUBLIC PARTICIPATION

Cleanup decisions at Superfund sites are made through the feasibility study process. The process ponds feasibility study has enabled ASARCO to weigh the effectiveness and costs of numerous options for controlling the releases of arsenic and metals to ground water from their primary sources on the smelter site. The report will soon be available. The public is encouraged to review and comment on EPA's and MDHES's proposed plan for a preferred cleanup alternative for the releases to ground water.

Decisions regarding residential soils, vegetation, livestock, surface water, and remaining ground water issues that extend beyond the process ponds will be evaluated in a comprehensive site-wide feasibility study. ASARCO has already begun assembling the data for this feasibility study, and expects to complete it by November 15, 1989. The site-wide feasibility study report will be available for public review and comment once it is approved by EPA and MDHES.

The feasibility study will include a risk assessment, which is being prepared for the East Helena site. This risk assessment will evaluate potential risk to the public, and establish remedial action levels that will protect human health and the environment. ASARCO expects the risk assessment to be completed by July.

The site-wide feasibility study will evaluate lead, cadmium, and arsenic levels in residential soils. Until the study is completed, it is premature to speculate on remedial action for East Helena. Among the remedial actions to be considered is soil removal and replacement.

EPA and MDHES want to do everything possible to keep East Helena area residents informed as these vital public health issues are evaluated. Concerned or interested citizens are encouraged to contact Scott Brown (449-5414) at EPA, or Kevin Kirley (444-2821) or Jane Stiles (444-2821 or 1-800-648-8465) at MDHES, if they wish to express concern or ask questions about any aspect of the East Helena Superfund site.

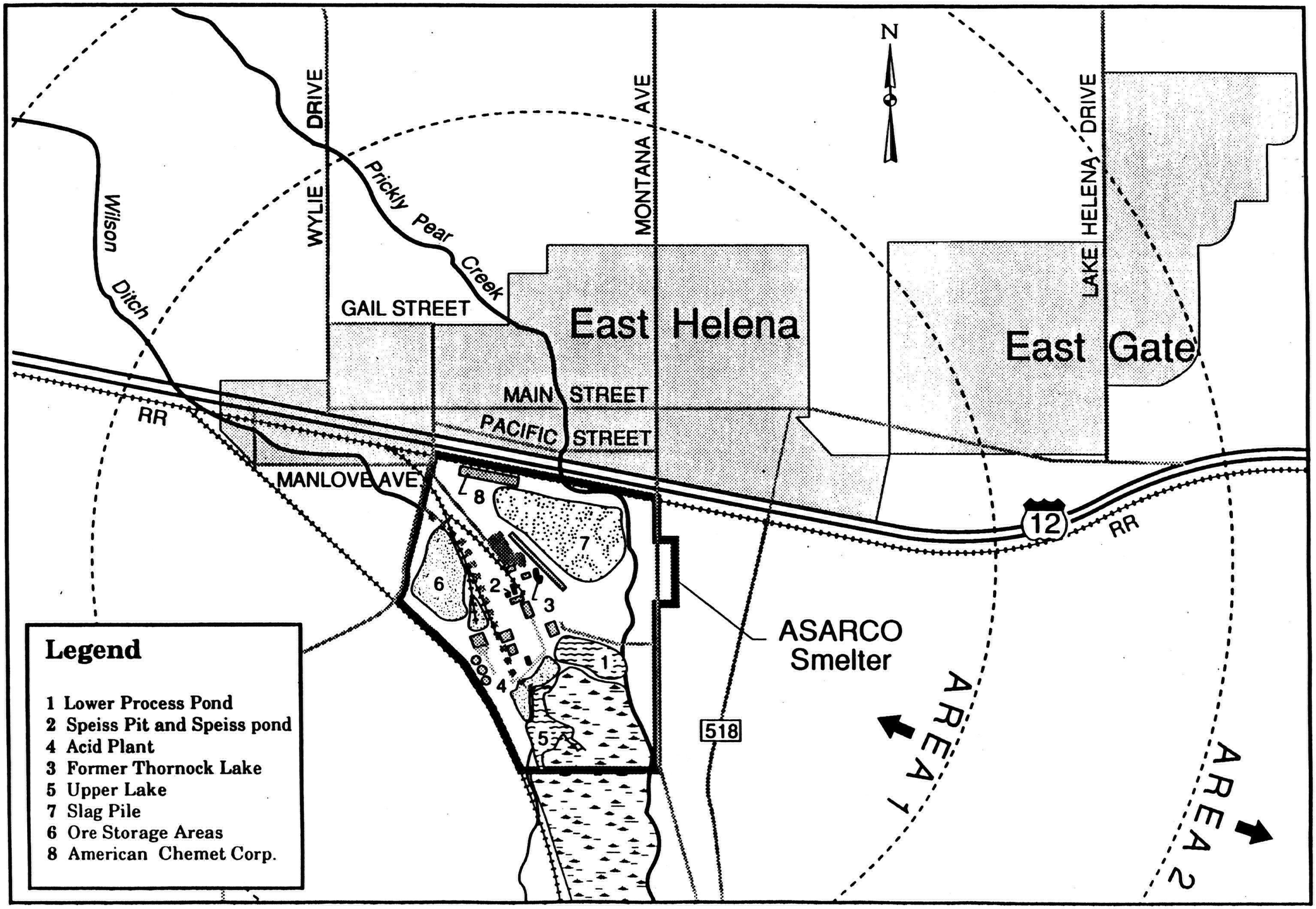
THE EAST HELENA SUPERFUND TASK FORCE

The East Helena Superfund Task Force was created during the summer of 1988. EPA and MDHES have coordinated their work with members of this task force. Its members live or work at East Helena, and act as liaisons for residents of East Helena, the East Helena City Council, EPA, and MDHES. If you would like to contact a task force member, you may do so by calling one or more of them at the telephone numbers listed below.

- Larry Moore, Mayor, East Helena — 227-5321
- Eric Palmer — 443-1719
- Ed Prebil — 227-5389
- Clark Pyfer — 227-6287
- Bill Schweyen — 227-6359

Figure 1

East Helena and ASARCO Smelter, Montana



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Reference 4

(Superfund Program Proposed Plan, East Helena Smelter Site)

Superfund Program Proposed Plan

EPA Region VIII

Montana Department of Health & Environmental Sciences

East Helena Smelter Site

East Helena, Montana

August 1989

EPA Announces Proposed Plan for Process Ponds

The U.S. Environmental Protection Agency (EPA) has made a preliminary recommendation for cleaning up the process ponds at the East Helena Smelter site. EPA is required by law [section 117(a) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 ("SARA")] to announce its preferred remedy in a Proposed Plan, and to provide a public comment period. This Proposed Plan summarizes information described in greater detail in the Process Ponds **Remedial Investigation/ Feasibility Study** (RI/FS) report of August 1989, which was prepared by Asarco Incorporated, the owner of the smelter. The Process Ponds RI/FS report and the **Administrative Record** file for this site are available for public review at the location listed at the back of this document. EPA's preferred remedy is not yet a final decision; questions and comments from the public must be taken into consideration before a final decision is made. EPA and the Montana Department of Health and Environmental Sciences (MDHES), invite the public to comment on the preferred remedy, as well as on the other alternatives evaluated, from August 31 to September 20, 1989.

Words shown in **boldface** are defined in the glossary on page 11.

Site Background

The Asarco smelter in East Helena is an operating custom primary lead smelting facility that covers approximately 80 acres. The smelter began operations in 1888 and currently processes ores and concentrates from around the world. The plant produces lead bullion that is shipped to another Asarco facility, where it is further refined. In 1927, the Anaconda Company constructed a plant adjacent to the lead smelter for the purpose of recovering zinc from the smelter's waste slag. This zinc plant was purchased by Asarco in 1972, but operations were discontinued in 1982. In 1955, the American Chemet Corporation constructed a paint pigment plant adjacent to the smelter; it is still operating.

In 1983, EPA added the East Helena Smelter site to its **National Priorities List** of hazardous waste sites, making it eligible for further study and possible action under the EPA Superfund program. Preliminary investigations (Phase I studies) of soils, vegetation, livestock, and surface and ground water were conducted from 1984 to 1987. The Phase I studies indicated that the Helena Valley in the vicinity of the smelter has been affected by emissions. The highest levels of metals and arsenic were found close to the smelter, but Phase I studies did not adequately define the degree of contamination. Therefore, EPA and MDHES entered into an **Administrative Order on Consent** with Asarco to conduct a second set of studies in the area. The Phase II studies, which Asarco conducted from 1987 to 1989, focused on livestock, vegetation, and soils located within approximately 2.5 miles of the smelter, and on ground water underlying areas within about one-half mile of the smelter.

To better manage the studies and eventual cleanup work, the site has been divided into five **operable units**. These operable units include the process ponds and fluids, ground water, surface water and soils, the slag pile, and the ore storage areas.

This Proposed Plan focuses on the process ponds, which studies have shown are major sources of metals and arsenic found in the soils, ground water, and surface water. For this reason, EPA has made the process ponds its top priority at this site. The remaining operable units will be covered during the Comprehensive Site-Wide RI/FS, to be completed this fall or winter.

The process ponds operable unit is further broken into four components: Lower Lake, the **speiss granulating pit and pond**, the **acid plant water treatment facility**, and former Thornock Lake. Lower Lake collects and stores water used in the main plant process circuit as well as storm water run-off. The speiss granulating pond and pit store water that is used to cool the hot speiss from the **dross plant** as part of the granulation process, and the acid plant water treatment facility removes particulates from the scrubber fluid. Thornock Lake was used to settle suspended solids from the main process water circuit until October 1986, when it was replaced by a tank. (See Figure 1.)

PUBLIC MEETING TO BE HELD September 12

You are invited to attend a meeting on September 12 about the cleanup remedies for the process ponds portion of the East Helena Smelter site. The U.S. EPA, MDHES, and Asarco will discuss the proposed solutions, respond to questions, and receive comments.

Time: 7:30 p.m.

Place: East Helena Firemens' Recreation Hall
4 East Pacific Street
East Helena, Montana 59635

Located behind City Hall, one block south of Main Street.

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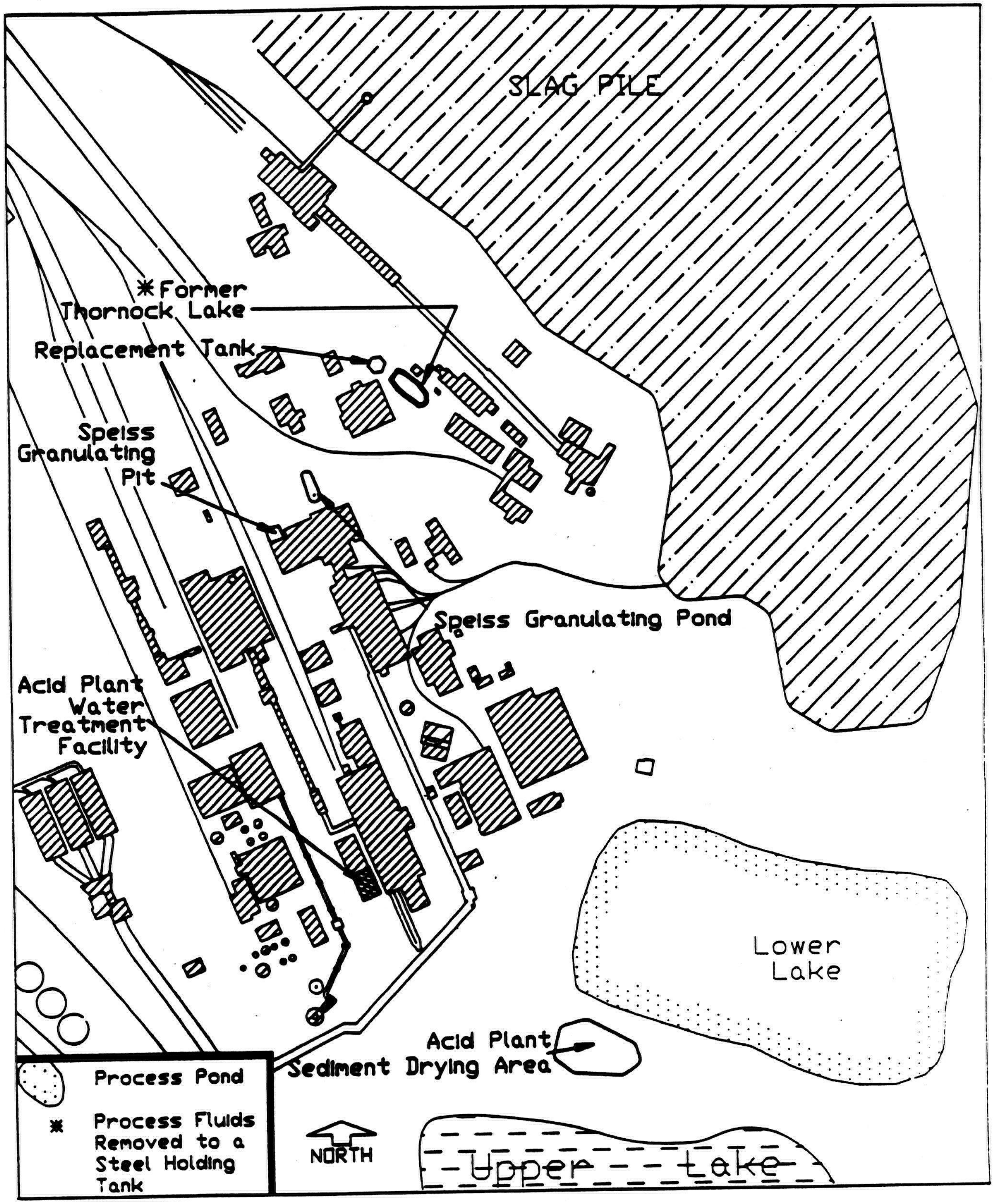

Figure 1. Process Pond Location Map

Summary of Site Risks

Fluids contained within the four process ponds exhibit high concentrations of some 20 elements that are hazardous substances, including arsenic, cadmium, copper, lead, and zinc. These elements have seeped into the soils and ground water both on and off the plant site. Although the highest concentrations are found underneath and adjacent to the four process ponds, the more mobile elements, such as arsenic, have been transported by natural ground water movement into the aquifers and soils underlying East Helena.

Arsenic, because of its mobility in relation to the heavy metals, and because it is a human carcinogen, is the element of greatest concern in this analysis. Monitoring wells in East Helena show arsenic concentrations greater than 20 times the federal drinking water standard of 50 parts per billion. Fortunately, such elevated levels have thus far been found only in shallow (20 feet or less) ground water.

Because the affected shallow aquifers are not a source of drinking water in East Helena, there is currently no direct human exposure to arsenic through ground water. Nonetheless, the potential does exist for human health risk to materialize if someday there is a need to tap into shallow aquifers for drinking water, or if the arsenic migrates into deeper aquifers.

Environmental risks associated with seepage and leakage from the process ponds are already a problem. Seepage from Lower Lake into Prickly Pear Creek adds to the problem of water quality standards already beubg violated in the creeks upstream of the smelter. These water quality standards are intended to protect fish and aquatic wildlife. In addition, seepage from Lower Lake and leakage from the acid plant water treatment facility and the speiss granulating pit and pond have introduced arsenic to the ground water under East Helena.

The remedial actions proposed by the Process Ponds RI/FS report will eliminate future contact between process fluids and underlying soils and ground water. Such source elimination is a vital first step in reducing the potential human health risks and current environmental risks discussed above. Still, source elimination is only the first step. The Comprehensive RI/FS report will address problems associated with the contaminated soils and ground water under East Helena, which is beyond the scope of the Process Ponds RI/FS.

Developing and Screening Cleanup Alternatives

During the Feasibility Study, Asarco developed more than 200 potential cleanup alternatives. The alternatives were compared to one another in terms of their effectiveness, implementability, and cost. Alternatives judged to be most promising on the basis of these three screening factors were retained for detailed analysis. Next, these alternatives were evaluated based upon their expected compliance with the following nine criteria:

- Protection of human health and the environment;
- Compliance with legally applicable or relevant and appropriate requirements (**ARARs**);
- Reduction of toxicity, mobility, and volume;
- Short-term effectiveness;
- Long-term effectiveness and permanence;
- Implementability;
- Cost;
- Community acceptance; and
- State and local agency acceptance.

EPA believes that the alternatives described in this Proposed Plan best meet the above criteria and, at the same time, provide a reasonable range of cleanup options for addressing the source contamination problems in the four process ponds. In some cases, alternatives were combined to provide greater assurance that the essential criteria will be met in this cleanup.

The Superfund program requires consideration of a "No Action" alternative at every site. The **No Action** alternative serves as a baseline for comparison with other alternatives. Under the No Action alternative, contaminated material would be left as is; however, EPA could require warning signs, or land use restrictions, or continuous monitoring of the affected soil and water.

Summary of Alternatives

All of the alternatives summarized below and shown in Table 1 involve soil or sediment removal. Because the soils and sediments underneath and adjacent to the process ponds show elevated arsenic and heavy metals concentrations down to the ground water-bearing gravels (at about 20-22 feet), it may be argued that excavation should be done to that depth. However, the concentrations of arsenic and metals in soils and sediments are greatest in the uppermost few feet and they decrease as depth increases.

In any feasibility study involving contaminated soils, the question of how much contamination may be left in place is a perplexing one. In the case of Lower Lake, it would be necessary to remove about 16 feet of wet sediments over a seven-acre area (180,700 cubic yards) to eliminate all arsenic- and metals-laden sediments. The cost would be approximately $78 million.

The results of soil leach tests may provide a reasonable alternative to complete removal of sediments. These tests examined the potential of arsenic and metals for leaching from soil as water percolated through them. The leachate (water percolated out) was collected from test soil samples and analyzed to see if it had picked up or dissolved the elements bound in the soil. These tests were run on soils and sediments from all process ponds except Thornock Lake. Concentrations of arsenic and metals in the test leachate varied among the soil samples, but analysis showed that at some soil depth (except for soils under the acid plant), leachate produced in these tests meets federal drinking water standards.

With that concept as the basis for determining the minimum extent to which soils and sediments should be excavated, many modifications of the alternatives were developed to examine whether other important factors might call for deeper excavation. State water quality standards, which are more stringent than federal drinking water standards, are a factor, as are technical practicability and sheer soil volume. Where appropriate, these factors and key modifications to the alternatives are discussed below.

Highlighted boxes surround EPA's preferred alternative for each process pond component.

Alternatives for Lower Lake

Alternative 1: No Action

Capital Cost: $0
Annual O&M Cost: $0
Implementation Time: None

With No Action, Lower Lake would continue to be used as the primary settling and runoff storage pond. Seepage of process fluids and potential leaching of arsenic from the lake bottom sediments would continue.

0230970

GRAIN

In August 1987, ASARCO's consultants collected 45 wheatgrain samples from various fields within the Helena Valley study area. In addition, three samples were collected from outside the study area in fields east of Canyon Ferry Lake. The information collected by ASARCO has been combined with results of the Helena Valley wheat studies conducted by EPA in 1984. This information, in conjunction with a survey of commercial crop use, will enable ASARCO, EPA, and MDHES to determine whether health risks exist for people who consume grain grown near the smelter. The results of these studies indicate that some grain fields in the Helena Valley are producing wheat crops with elevated levels of arsenic, cadmium, and lead compared to the grain samples collected east of Canyon Ferry Lake.

ASARCO also conducted a survey to define the local production, marketing, and consumption of cereal grains grown in the Helena Valley. Five households were identified in the Helena Valley that consume local grain products. EPA and MDHES will evaluate and make recommendations on the effects of consuming metals in locally grown grains.

LIVESTOCK

In December 1987, ASARCO and its consultants purchased and slaughtered twelve cattle from two different herds raised near the smelter, and six other animals from a ranch near Townsend. Samples of beef muscle, liver, and kidney were analyzed for arsenic, cadmium, lead, and zinc to help determine the risk of eating beef from cattle raised near the smelter.

Concentrations of arsenic, lead, and zinc in the tissues of cattle raised in the Helena Valley were not markedly different from those found in the Townsend area cattle. Levels of these three elements found in the Helena Valley cattle and Townsend area cattle also did not differ significantly when compared with test results of cattle from throughout the United States and Canada.

In contrast, cadmium concentrations were significantly elevated in the kidneys and slightly elevated in the livers of both the Helena Valley and Townsend area cattle in comparison with national studies.

The U.S. Department of Agriculture (USDA) has collected information on test results of metals levels in kidney, liver, and muscle tissue in over 2,100 cattle. Cadmium concentrations in cattle kidneys represented in this national survey averaged 0.5 ppm, and ranged from 0.01 to 7.82 ppm. In comparison, the test animals from East Helena averaged about 6.0 ppm, with a range of 0.6 ppm to 21.6 ppm, and two of four test animals from the Townsend area had slightly more than 10 ppm cadmium in their kidneys.

Cattle accumulate cadmium in their kidneys and liver with age. Because the test animals from Townsend were over ten years old, normal cadmium levels in the soils and feed there probably accumulated in the animals over time. Yet, all of the test animals, from both East Helena and Townsend appeared healthy.

Information collected by the World Health Organization on the effects of cadmium levels in humans shows that consumption of excessive cadmium over time can cause kidney dysfunction or failure. As in other mammals, the kidneys are the human organ most susceptible to cadmium. The World Health Organization recommends avoiding kidney or liver in excess of 0.5 ppm cadmium, and muscle tissue in excess of 1.0 ppm cadmium. Until the risk assessment is completed, EPA and MDHES advise people to avoid eating kidneys from cattle raised in the East Helena area.

All of the muscle tissue tested from the East Helena and Townsend cattle was considerably below 1.0 ppm cadmium. In fact, none of the muscle tissue exceeded 0.04 ppm.

RESIDENTIAL SOILS

ASARCO's consultants also collected surface soil samples from 28 yards and play areas within East Helena in the fall of 1987. The samples were tested for arsenic, cadmium, lead and other harmful elements. The results of ASARCO's soil sampling effort were similar to two earlier soil sampling studies.

The first soil study was done in 1983 by a team of researchers from the National Centers for Disease Control of Atlanta (CDC) and the Montana Department of Health and Environmental Sciences (MDHES). The second soil study was done for EPA by Montana State University in 1984 and 1985. The three soil sampling studies together provide useful information on approximately 275 separate sites within about two miles of the smelter, and with an emphasis on residential areas.

Arsenic, cadmium, and lead in the soil are the elements of concern to the EPA and MDHES. Results of studies at East Helena indicate that, of these three elements, lead is the most prevalent and dangerous. Roughly half of the yards and play areas sampled within East Helena have more than 1,000 parts per million (ppm) lead in the surface soil. Many of these were found to have more than 2,000 ppm lead, and some are in the range of 3,000-7,000 ppm.

The National Centers for Disease Control has been studying the problem of lead in the environment and its effects on human health for many years. The CDC has identified 500-1,000 ppm as a range of concern because of the potential for children coming into direct contact with soils containing levels of lead in or above that range. EPA has ordered cleanup actions at a number of other Superfund sites where soil lead levels exceed 1,000 ppm.

Studies of lead in the blood of children nationwide, particularly those children from one to six years old, led the CDC more than a decade ago to establish an "action level," or a level above which medical treatment for lead poisoning is advised. In 1974, the action level was 40 micrograms of lead per one deciliter of blood. A few years later, the CDC reduced the action level to 30 micrograms per deciliter. In 1985, it was reduced again to 25 micrograms per deciliter. In March 1986, EPA's Clean Air Scientific Advisory Committee recommended lowering the blood lead action level further, from 25 micrograms per deciliter to nine micrograms per deciliter. Decisions by CDC to reduce the action level have been influenced by mounting evidence that lead can result in serious and irreversible intellectual impairment in children with only small amounts of lead in their systems.

The results of blood lead studies of East Helena children can be viewed both positively and negatively. On one hand, a definite decrease in blood lead has been observed. Comparing the 1975 study with the 1983 study, fewer children exceed the current lead action level established by the Centers for Disease Control. On the other hand, East Helena children still have about twice as much lead in their blood as the national average for children. According to the 1983 study, approximately 35 percent of the East Helena children had blood lead above 15 micrograms per deciliter.

WILSON IRRIGATION DITCH

During Phase II soil studies, EPA, DHES, and ASARCO identified significantly elevated levels of arsenic in the soils and sediments of the Wilson irrigation ditch. The ditch begins at the east edge of the smelter, passes underneath the smelter site, and runs open through the yards of residences in the Manlove subdivision (see map).

0230971

Reference 5

(Telecon August 22, 1990, between Mary Wolfe, SAIC, and Scott Brown, EPA Region VIII)

0230972 msg 8/21

SAIC
An Employee-Owned Company

Contract No. ______

Contact Report

Originator: Mary Stagge   Date: ~~8/14/90~~ 8/22/90   Time: 12:30

Made Call ☑   Received Call ☐   Meeting at SAIC ☐   Meeting At ______ ☐

Person(s) Contacted (Organization): 406-449-5414 Scott Brown EPA Region 8

SAIC Personnel:

Purpose of Contact: East Helena

Significant Topics Discussed: 8/22 11:54 p.m.

1) process ponds - ROD signed → Consent Decree signed 6/30/90 in process of remedial design + in process of negotiation w/ PRP.
2) groundwater Draft RI/FS
3) slag pile "
4) ore storage "
5) surface H_2O, soils, vegetation, fish + wildlife "

Comprehensive RI/FS is in draft stage (april) will be 6 volumes, 3 ft. thick written by PRP, but there are problems w/ RA. Enormous amt. of RI data. will be some months until RI/FS is finished

All handled under Superfund authority.

Action Items:

Person Responsible	Required Action	Date Required

Distribution: